*Official Journal of the*
INTERSTATE POSTGRADUATE MEDICAL ASSOCIATION
JUL 9 1947
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# Postgraduate Medicine

VOLUME I, Number 5 MAY 1947

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# The Clinical Course of Coronary Disease

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This discussion of coronary disease will be restricted to atherosclerosis, the group which comprises by far the greatest number of cases. Disturbances of coronary function resulting from sclerosis will be reviewed, and the varied and varying course of clinical coronary disease will be outlined. Some essential features of the anatomy and physiology of the coronary circulation, both normal and pathological, first may well be reviewed.

## Anatomy and Physiology

In later years it has become well known that there is a rich network of anastomoses which runs throughout the muscle and connects terminals not only from neighboring small branches, but even from the right and the left coronary. It now appears that, instead of increasing the number in later years, nature laid them down to begin with—many tiny communicating filaments with little to do but ready when called on. If there is any interference with arterial flow in one locality, an inflow of blood is sent from less obstructed territory through these subsidiary channels, which enlarge with use.

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NOTE: Read before the meeting of the Interstate Postgraduate Medical Association of North America, Cleveland, Ohio, October 15 to 18, 1946.

### Two important factors in the regulation of coronary flow

In order to meet changing requirements, the amount of blood supplying the normal heart muscle must be subject to variation. For the most part, this variation in coronary flow is accomplished by change in coronary pressure, which automatically follows any change in the mean level of blood pressure. This automatic change in coronary pressure operates irrespective of any change in the caliber of the vessels; but vessel caliber also may change and thus may influence coronary flow. There is, however, an overall mechanism, beautifully and delicately balanced, which tends to guard against too great variation in vessel size. A constant stream of sympathetic stimuli to the coronary arteries tends to keep them in a mild state of tonic dilatation. Normally this dilatation overbalances the stimuli of the vagi, which tend to cause constriction and reduction of flow. Thus, tonic dilatation minimizes the effect of reflex vagal constriction, which might arise from pain, for example, and which, if strong, might otherwise suddenly lower coronary flow.

### CORONARY INSUFFICIENCY AND SCLEROSIS

The term "coronary insufficiency" implies that, under given conditions, the coronary flow is inadequate for normal needs. The insufficiency may be relative; that is, if the flow is augmented—by exercise, for example—and it still is not great enough for the yet greater requirement of the moment, *relative* insufficiency exists. If actual diminution of flow—from narrowing of an artery, for example—produces the insufficiency, it is termed *absolute*.

A sclerotic vessel may contribute to insufficiency in several ways. It may be unable to dilate normally in response to normal sympathetic stimuli, thus promoting relative insufficiency. Sclerosis also may narrow the caliber and thus cause absolute diminution or even stoppage of flow. It is evident that hypernormal constrictor stimuli (vagal) also could produce absolute insufficiency. This might take place in certain areas even in the presence of considerable sclerosis in other locations. Under such conditions, indeed, the consequences of constriction might even be especially serious.

### Latent Coronary Disease

In the normal coronary circulation, as in the function of other organs, nature rarely calls regularly for full capacity. A considerable restriction of coronary flow may occur without impairment of usual function. Sclerosis of fairly large extent may be present without symptoms. The very effect of local insufficiency tends to develop collaterals which arise in more fortunate areas.

Postmortem studies show that in a very large percentage of adults past middle age who died of causes unrelated to the heart and who had no history of cardiac symptoms, coronary sclerosis of greater or less extent was present. In these people, nature's reserves sufficed. No important effects of restricted flow ensued. In coronary sclerosis uncomplicated by hypertension, congestive failure, valvular disease, or other cardiac lesion, there is little if any enlargement of the heart, no murmur, and in many instances no abnormality of the electrocardiogram. In these cases of latent coronary disease, diagnosis commonly waits on postmortem examination.

### Clinical Coronary Disease

Coronary sclerosis, however, may restrict blood flow below the level necessary for proper muscle function. Coronary insufficiency thus produced may last for brief intervals or for long periods. Angina, myocardial infarction, and congestive heart failure may result.

In reviewing separately these various manifestations of clinical coronary disease, I shall ask you to note the fact that they divide themselves primarily into two rather separate and distinct groups, and that the symptoms of the one are quite different from the symptoms of the other; they are diverse. There is indeed very strong evidence that the symptoms associated with the one group are in fact more or less incompatible with the situation existing in the other. In one group there are evidences of acute disturbance related particularly to the coronary arteries; this occurs in cases of angina and of acute infarction. In the other group there are evidences of chronic impairment of the heart muscle; such are cases of congestive failure. In the acute arterial cases the characteristic evidences of congestive failure regularly are lacking; in the more chronic muscular cases with congestive failure, the clinical manifestations of acute arterial disturbance regularly are in abeyance. The patient with acute coronary disturbance may be destined ultimately to travel the other road, but rarely does he go both ways at once.

In like manner, the patient with primary muscular insufficiency commonly exhibits none of the evidences of acute coronary disturbance. The explanation of this rarity of angina and of infarction in primary congestive failure is not entirely complete. Change in blood volume might be the differential. Congestion of the coronary veins in congestive failure has been thought to explain it. Muscle space may hold the answer. The patient with uncompli-

cated angina shows no cardiac enlargement, whereas enlargement regularly accompanies congestive failure. The following consideration appears to bear upon the problem. In congestive failure the elements of ventricular muscle are less compact; they occupy more space, and consequently they may be expected to allow more room for coronary flow. Conversely, as the dilated muscle improves, the coronary bed may be relatively encroached upon. Whatever the explanation, angina does not give the signs and symptoms of congestive failure; during congestive failure the occurrence of angina or of infarction is rare.

### ANGINA

Temporary myocardial ischemia, relative or absolute, commonly produces a more or less characteristic sensation. It is usually substernal, but the location may be confined to one or both arms, the elbow, the left or right chest, the back, or the epigastrium.

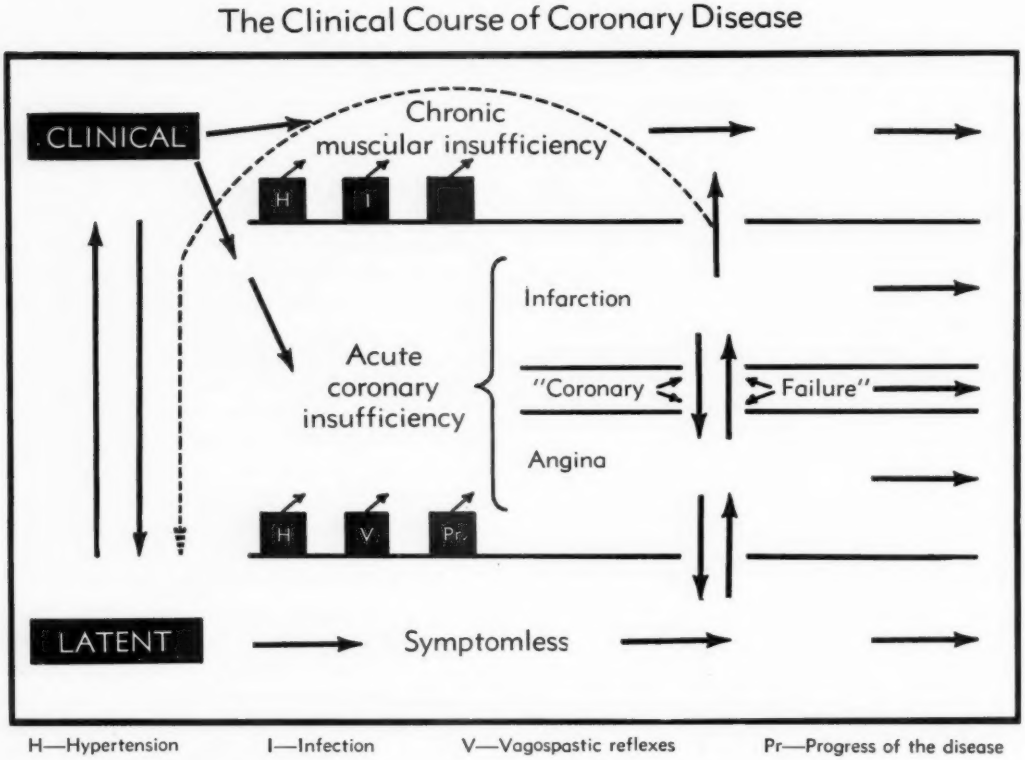
Characteristically it occurs with exercise—especially in the early morning, more regularly after a meal, and particularly after the early morning meal. It often occurs with emotion, after a breath of cold air, sometimes on taking food, or on arising from a sitting posture. It may occur in the night or on arising. More rarely—and particularly in relatively serious cases—it may occur while sitting, particularly after eating, and in association with excitement or other "tension." Usually, but not invariably, it yields readily to nitroglycerin 1/200 grain or less, in the mouth. In many instances the patient refuses to designate the sensation as pain, and objects to that term. In others, the pain is excruciating. He often refers to it as "shortness of breath," but careful questioning nearly always reveals that it is not associated with increase in number or depth of respiratory movements. The pain instead may seem to shut off his breath or "to take his breath away," not to increase his breathing.

Cessation of effort, subsidence of emotion, belching of gas, or removal of other precipitating factors, regularly is soon followed by disappearance of the attack. In most instances the duration is measured by minutes. Chest pain that lasts longer than a matter of minutes should be regarded as due to causes other than coronary disease or to some other disturbances of the coronary circulation mentioned below.

Angina occurs particularly in individuals who take responsibility seriously, especially in those working under tension. It is often associated with hypertension and with digestive disorders, which appear to be contributory factors.

The term "angina of effort" often carries a wrong implication, and it would be better to use only the word "angina." In a large proportion of patients with angina, it is true that the occurrence of pain appears to depend upon relative coronary insufficiency induced by physical activity. In many other cases the circumstances of onset strongly indicate that the insufficiency is absolute, resulting from reflex nervous effects which reduce the coronary flow, there being at the moment no particular need for increase in blood. It would be difficult otherwise to explain the occurrence of anginal pain from a breath of cold air, or some of those cases in which the pain follows the mere swallowing of food. Long ago it was well known that angina occurs particularly after a meal. The frequent association of angina with various disorders of the stomach, gallbladder, duodenum, and colon gives strong clinical evidence that in some cases a hypersensitive or overdeveloped constrictor reflex (vagal) may be responsible for the attack, in patients with coronary disease, by reducing still further the coronary flow which was near the critical level because of sclerosis. Certain clinical experiments support this view. Attacks of angina have been induced by mechanical distension of the esophagus or of the stomach.

Gilbert and his co-workers have furnished very important experimental evidence, both from patients and from the animal laboratory, that anginal attacks may be induced by vagal stimulation. In producing angina by administering a low oxygen mixture to susceptible patients, and noting the time that was required to




In the figure above, the varying course of coronary disease is graphed. It will be noted that cases with symptoms may become symptomless, and *vice versa*. Or symptoms may change, the clinical cases tending to be classified into rather distinct groups. Some of the factors which may influence the course of the disease are indicated.

produce any pain, they found that the attack came at an earlier moment in the experiment if the patient had had a full meal first, but that this earlier appearance of pain did not occur if atropine had previously been administered.

These experimental results, as well as many of the longstanding clinical observations, are easily explainable as due to reflex vagal constriction, hardly on any other basis. The view is held by some that constriction of the coronaries may result from irritation of the vagus center and may be strong enough on occasion to produce serious ischemic effects in the myocardium even in the absence of notable sclerosis of the arteries. Although the evidence in favor of vagal effects in precipitating attacks in certain cases of angina is impressive and should always be kept in mind, the evidence also is overwhelming at present that coronary disease of greater or less extent also exists in almost if not in all cases, except in those associated with thyroid disease, anemia, or in other easily explainable situations.

In many patients attacks of angina constitute the only demonstrable effect of coronary disease. In such cases obviously the diagnosis can be made only from the history, but in most instances this is sufficient. Evaluation of the history may present considerable difficulty, but as a rule the characteristic features can be elicited

or excluded by painstaking and detailed questioning.

*Course*—Coronary disease of extent sufficient to produce angina is a serious matter. Sudden death may occur. Complete occlusion with or without myocardial infarction may ensue. Congestive failure may follow. In many instances the development of collaterals, the avoidance of precipitating factors, and the relief of accompanying disturbances may result in temporary or permanent cessation of attacks, the disease then becoming latent. In many cases proper attention to abdominal symptoms yields valuable results. And equally if not more important, the patient should have the confident assurance from his doctor that nature, continually at work to develop an adequate collateral circulation, may count him among her successes.

### CORONARY OCCLUSION AND MYOCARDIAL INFARCTION

Acute occlusion of a diseased coronary artery commonly implies thrombosis but it may occur in other ways. Atheromatous material may block it. If the closure develops slowly, giving time for the development of adequate collaterals, the ischemic area may not undergo infarction. Blumgart has shown that many cases of angina originate in this manner. Infarction itself may not imply complete closure. Its characteristic clinical picture depends not on the method of origin but on the infarct itself.

*Occurrence*—The circumstances attending the initial symptoms of acute infarction usually present certain differences from those attending the occurrence of angina, but they commonly show certain similarities as well. Angina occurs so characteristically with effort that it is commonly called "angina of effort." The initial evidences of thrombosis, on the other hand, are relatively rare with effort. Indeed, a certain amount of physical activity may tend to prevent thrombosis. Activity promotes coronary flow and thus opposes thrombus formation even though the increased flow may yet be inadequate (and thus induce angina). There has been much discussion as to the precise relationship of infarction to physical activity. So far as concerns those cases resulting primarily from thrombosis, there would appear to be little room for argument. Although exceptions are well recognized, the symptoms of infarction from thrombosis characteristically begin when the patient is relatively quiet, particularly during sleep, when blood pressure is lowest and coronary flow consequently diminished. Angina at night, indeed, may result from the same mechanism. In patients with coronary sclerosis, circumstances which lower blood pressure on occasion may therefore carry considerable risk of inducing thrombosis.

THERE is considerable evidence of strong reflex vagus stimulation in many cases of infarction as well as of angina. The association of infarction with disorders of the gallbladder, stomach, and other abdominal viscera has long been recognized. Perhaps the commonest effect on rhythm in acute infarction is sinus arrhythmia with slowing of the rate. Some of this vagus stimulation well may result from the infarction itself, but evidence of a causal relationship, by restriction of coronary flow, often is impressive. By avoiding such reflex nervous effects the risks of infarction as well as of angina obviously may be lessened. Evidence has been advanced to show that, in acute occlusion, reflex vagus effects overflow to neighboring coronary branches, thus augmenting the ischemic effects and tending to enlarge the affected area. Experimentally this vagal constriction is counteracted by atropine. Such considerations make clear the rationale of giving atropine early in acute infarction.

The clinical features of myocardial infarction vary in occurrence and also in intensity. Unlike angina, the pain, unless relieved, usually is measured by hours. It may diminish or disappear and then recur without apparent exciting cause. Nitroglycerin usually has little effect. If the diagnosis is clear, it should not be used. Often there is dyspnea, occasionally as the main presenting symptom. The patient may be in shock. Syncope is not unusual. The attack may

be characterized principally by dizziness. Upon occasion there is no pain. Almost always fever develops. The blood pressure may even be elevated for a time, but in most cases it falls sooner or later. Usually there occur leukocytosis, increased sedimentation rate, and electrocardiographic changes which commonly, but not invariably, are characteristic. Pericardial friction may be noted.

The myocardial effects of acute infarction are more profound than in most instances of angina. As a rule, however, the initial circulatory effects do not indicate muscular insufficiency with congestive failure. In some instances acute muscular failure occurs; and in others chronic congestive failure follows. The heart muscle in acute infarction, however, is involved in a process altogether different from that which obtains in chronic muscular insufficiency.

*Course*—It is widely recognized that death may occur early in infarction, but it is also now well known that the dire forebodings of some ten or fifteen years ago in very many cases have had to be revised. If the patient is in good condition a week or two following his attack, his chances for returning to activity are good. Embolism or other serious event may still supervene, but in general, the first few weeks give excellent prognostic implications. In many instances recovery is complete, and the patient lives out his expectancy with no cardiac symptoms. Subsequent attacks may occur, which may be more or less severe than the first. I have observed some cases in which even the third attack has left the patient well able to look after his work with little or no clinical evidence of heart disease.

In other instances invalidism results. The patient may be in a chronic state of coronary insufficiency with attendant symptoms. Congestive heart failure may ensue. Even so, complete recovery without need for digitalis may take place.

### CORONARY INSUFFICIENCY

In many instances of acute coronary insufficiency, the clinical distinction between angina and infarction is not as clear-cut as may have been indicated. The pain may last for long periods and may recur frequently with little or no apparent provocation; the patient evidently is quite ill, even though the criteria of infarction are absent. In some instances infarction supervenes; in others the pains subside and the patient improves without clinical infarction. Blumgart has suggested for such cases the designation "coronary failure." Others have suggested the term "impending" occlusion or infarction. The term "coronary insufficiency" has been proposed to separate such cases from other better classified instances of insufficient coronary flow. Whatever name may be used, it is essential to recognize the fact that such patients need special care and observation. Even though the situation usually is critical, in many of these, as in other instances of coronary insufficiency, the development of collaterals relieves the situation, and the patient reaches a high level of activity again with or without angina.

### CONGESTIVE FAILURE

In many individuals coronary disease is an important factor in the development of congestive heart failure. The precise mechanism in the evolution of failure in such cases is not entirely clear. For certainly in many cases there is no exact parallel between the degree of coronary sclerosis and the presence or absence of congestive failure. According to Clawson, sclerosis tends to prevent hypertrophy. Whether sclerosis alone ultimately may induce congestive failure, without infarction and without other accessory factors, might be difficult of proof. In most instances of coronary disease hypertension also is present to put added strain upon the heart. Often infection appears to be significant. However, restriction of coronary flow itself, existing over a long period of time, must also be a large factor in myocardial insufficiency, especially if the impoverished muscle is subjected to undue strain. Although coronary disease per se tends to prevent enlargement, failing heart muscle regularly undergoes hypertrophy and dilatation whatever may be the underlying factors in the

failure. Usually the left ventricle is the first to show impairment of function, the presenting evidences being congestion of the lungs with breathlessness.

*Course*—As a rule, the course of congestive failure in patients with coronary disease is not particularly different from that in other patients. Precise differentiation of all contributory causes may be quite difficult. On occasion, with control of accessory causes, proper therapy may enable the muscle again to function well for an indefinite time.

SUMMARY

Coronary disease may exist without apparent effect on muscle function, or, under various circumstances, it may result in failure of the muscle to perform its work in a normal manner. This failure to work properly may be characterized by diminution in pumping capacity, i.e., "congestive failure"; or it may be manifested by pain, i. e., "anginal failure." Rarely does the patient experience both types at once. There appears to be an incompatibility between them.

The coronary patient with chronic congestive failure commonly is one who has undergone long-standing restriction of coronary flow, to which usually has been added some important contributory factor. In most instances the course is not conspicuously different from that observed in other cases of congestive heart failure. Evidences of acute coronary insufficiency rarely are present.

The patient with anginal failure is one who has experienced an acute coronary insufficiency. There is much evidence that this acute insufficiency in some cases may be superinduced by hypersensitive vagal influences. It may take the form of angina or of myocardial infarction. From either of these acute types the patient's course may lead to the other. Or, especially in cases of infarction, it may lead to chronic muscular insufficiency.

Along with restriction of coronary flow, there is a progressive development of the intercommunicating collaterals. In many cases of acute coronary insufficiency this collateral circulation increases to such an extent that again the circulation is adequate and the patient no longer experiences the symptoms of insufficiency.

## ALLOXAN

One of the most interesting recent developments in the field of diabetes has been the discovery of the selective destructive action of alloxan for the islets cells of the pancreas. Animals into which alloxan is injected develop a diabetes which in many notable respects resembles human diabetes.

But aside from its value in the study of diabetes, alloxan has been considered as a possible agent in the treatment of persons suffering from hyperinsulinism caused by islet cell carcinoma. A small number of investigators have used alloxan for this purpose. Results have been disappointing, for it has been found that injection of alloxan produces severe liver necrosis and fatal toxic reactions. Though the normal islets of Langerhans are destroyed, islet cell adenomas appear resistant to the action of alloxan. Because of its extreme toxicity, its use in human beings is not advised.

# Present Methods in the Treatment of Anterior Poliomyelitis

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INFANTILE paralysis is a disease due to a neurotropic virus, the effects of which are most variable. The acute febrile part of the illness, at the start, may be nonspecific in type, but it soon exhibits symptoms referable to the central nervous system. These include headache, irritability, muscle sensitivity, muscle spasm, and paralysis. Paralysis may or may not occur. If present, it tends to be patchy in distribution with regional localizations. It may be widely distributed and almost complete. The individual muscles may be affected in any degree from barely detectable weakness to complete paralysis. The sensitivity and spasm are self-limited and, in most cases, of relatively brief duration. The spasm may range from barely perceptible to severe. It may persist for months but ordinarily it lasts only a few weeks.

Prognosis as to recovery depends more on the degree of original involvement than upon any other factor. Death, if it occurs, is usually due directly or indirectly to bulbar involvement or to paralysis of the muscles of respiration. Since the disease presents a combination of paralysis, sensitivity, and spasm, it is particularly deforming and since deformities with shortened muscle become fixed with fibrous and fascial contractures, if they are allowed to develop, they tend to be maintained. In children, secondary growth disturbances produce still further abnormality. Once the acute illness is over, the picture of paralysis is always one of improvement. Some muscles may remain completely paralyzed, others recover completely, and there are all variants in between. The total picture, however, is that of improvement.

The degree of recovery which will occur cannot be estimated accurately in the early stages of the disease. The greater the degree of paralysis and the more extensive its regional distribution, the worse the prognosis.

## STAGES OF DISEASE

The course of the disease is such that it seemed wise to Lovett, years ago, to subdivide it into stages, and such a division, considerably modified, is desirable in our consideration of treatment.

Now this is the disease about which there is so much confusion, so many claims and so many counterclaims. Why is this?

The nature of the disease itself is a large contributing factor. There is no way in the initial stage before paralysis occurs to estimate the degree of paralytic involvement which will ensue, nor in fact to determine accurately in the early stage of paralysis the degree of recovery which may occur. It is natural to ascribe the results attained to whatever treatment is

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NOTE: Read before the meeting of the Interstate Postgraduate Medical Association of North America, Cleveland, Ohio, October 15 to 18, 1946.

followed. Even if no treatment is given, a very considerable percentage of patients seen in the early stage will either have no recognizable paralysis or very little and complete recovery. This becomes of greater significance when considered in relation to the great variation in severity of the disease, not only in individual cases but in particular epidemics.

TABLE I

STAGES OF DISEASE

I. Acute Stage—Period of acute febrile illness.
   A. Preparalytic phase
      1. Period of acute illness before paralysis is discernible.
   B. Paralytic phase
      1. Period from onset of paralysis to end of febrile stage.

II. Convalescent Stage or Stage of Recovery—Period of convalescence when recovery of muscles may occur. Arbitrarily, it may be said to terminate 16 months after the onset.
   A. Sensitive phase
      1. Period when muscle sensitivity and spasm are present.
   B. A-sensitive phase
      1. Period after sensitivity and spasm have subsided.

III. Chronic Stage—Period starting with end of Convalescent Stage.

FOR EXAMPLE, if all the cases seen later than the earliest stage of the disease are discarded from the series which is reported, on the basis that the treatment is not effective unless it is given from the start, the recovery on a percentage basis will be high, since many nonparalytic cases or cases with the mildest involvement will be included in the series.

I cannot help but emphasize the natural recovery which occurs in infantile paralysis. I believe that I can best illustrate this by a quotation from a textbook published in 1894. In the chapter on anterior poliomyelitis was this statement: "If genital irritation exists and phimosis be suspected as the cause, circumcision will be indicated as soon as the more acute symptoms have subsided, and may be followed by the speedy amelioration of the paralysis; but the writer now has a boy under his care in whom circumcision, undertaken by another surgeon after the attack, had no effect whatever on the paralysis."[2] In other words, whatever is done many patients get well. I cannot pass without affirming that treatment has much to do with the outcome, but certainly spontaneous recovery must be considered in evaluating results that are obtained.

WILLIAM T. GREEN

Upon this setting, we have had extravagant claims and promises regarding the results of particular treatments. Add to this the intense public interest in this disease, which cripples children, together with publicity of a type and amount never before existing in the history of medicine, and there is little wonder that confusion has existed.

## HISTORICAL BACKGROUND OF TREATMENT

It is well to recall some features of the historical background of the treatment of the disease. It appears that the late Robert Lovett, formerly chief of the Orthopedic Service at

our hospital, had as much to do as anyone with the placing of the treatment of the disease upon a good foundation. His activities were confined to the first quarter of this century.

He subdivided the disease into stages, pointing out that the treatment varies as to the stage. He described the acute stage as persisting until muscle tenderness disappears. He emphasized that flaccid paralysis, due to involvement of the anterior horn cells, was the outstanding feature of the disease, although affirming the work of Peabody, Draper, and Dochez that other parts of the central nervous system were affected.[3] He stressed the sensitivity of the muscles in the acute stage, their rigidity, and the deforming tendencies. Spasm in muscles of the neck, the hamstring muscles, and the back were described as an important diagnostic feature. He emphasized that deformities must be prevented and advocated the use of splints, when indicated for this purpose. He recommended rest and the support of parts in the acute stage as well as avoidance of massage and strenuous physical therapeutic measures which he felt prolonged the period of sensitivity. He advocated warm baths and hot foments for sensitive muscles.

In the convalescent stage, active exercises directed toward the function of specific muscles were performed. A technique of muscle examination was evolved, classifying the individual muscles as to strength into six grades—zero, trace, poor, fair, good, and normal.[1, 4] This grading is the method in current use today. At this stage, too, emphasis was placed on the prevention and correction of deformity and splints were used as necessary.

The patient was gotten up after not too long a period as he believed that the upright position was desirable quite early in the convalescent phase. Braces were used as indicated. It was stated that if a patient cannot stand or walk unaided, or stands or walks in a position of deformity, as with a hyper-extended knee, the use of a brace was desirable. He emphasized the importance of muscle imbalance in producing deformity.

In the chronic stage the concern was to develop and maintain as satisfactory function as possible.

Since this original outline by Lovett, evolutionary changes have occurred. The late Arthur T. Legg, who succeeded Lovett, advocated the use of hot packs during the sensitive stage.[4] Guided active exercises were started at an earlier period in the disease. Underwater exercises came into greater use. The importance of early passive motion to prevent stiffness was advocated.

Now there were others who recommended a greater degree of immobilization and exercises involving limited arcs of motion, and still others who felt that treatment was of little help.

Upon this setting comes the treatment developed by Sister Kenny, but which itself is going through an evolutionary phase. This treatment was proposed as a radical departure from previous concepts and was claimed to be revolutionary in its results.

THE THREE cardinal features of the disease as proposed by Sister Kenny are (1) muscle spasm: "the affected muscles are the muscles in spasm," (2) incoordination, and (3) mental alienation.[5]

Pohl asserts that: "Spasm of muscle is the earliest, most common and most damaging finding affecting the muscles in acute anterior poliomyelitis." Paralysis due to destruction of anterior horn cells is recognized as occurring, but it is held that "paralysis proves after all to be a minor consideration in most cases of infantile paralysis." The treatment proposed by Sister Kenny is directed toward the muscle spasm, incoordination, and mental alienation. Great effort is directed toward minimizing the spasm with the idea that the course of the disease will be greatly influenced.

Mental alienation is a term used to describe a condition in which there is an inability to produce a voluntary purposeful movement in spite of the fact that the nerve paths to the

muscle are intact, a "physiologic or psychologic" block. The majority of the muscles described as alienated by Sister Kenny are those which I would evaluate as exhibiting either a flaccid paralysis or paresis.

Involved in the technique of treatment are the use of hot packs on a regular schedule by a particular method, the avoidance of underwater therapy, as well as splints and casts, which are ascribed as being harmful. However, attention is given to the position of the parts, particularly through nursing care and the use of a footboard. The purpose of the footboard is allegedly not to hold the foot but to stimulate proprioceptive reflexes. Muscle education is started at a relatively early stage; its features will not be outlined here. The techniques in many respects seem to be similar to those which are in use in certain of the so-called orthodox methods, although they are described as being performed for a different purpose and to be based upon a different concept of the disease. Sister Kenny does not do a muscle examination, that is, does not evaluate the power of the individual muscles, but does what is called a muscle analysis, which primarily is a recording of the spasm present.

The respirator is described as not having a place in treatment. Braces are said not to be necessary and deformities such as scoliosis are stated not to occur.

Others recently have recommended the use of curare, intramuscularly, together with strenuous manipulations and early activity, encouraging any motion which moves the part. This technique has been described as producing superior results. Other drugs are advocated as having particular virtue. What of all this?

## PATHOLOGY

Let us first consider the pathology of the disease. The histologic changes in the central nervous system are quite widespread. Not only is the spinal cord involved, but various portions of the brain, and even the posterior ganglia. However, the most destructive action occurs in the gray matter of the anterior horn and in adjacent cellular areas.

The pathological changes seem to be due primarily to the effects of the virus upon the neuron with the edema, and cellular infiltration representing secondary phenomena.

The weakness of a muscle is in turn, due to loss of neuromuscular units, that is, loss of those muscle fibers innervated by the involved neurons. For example, a muscle classified as "trace" has enough units working to provide a palpable contraction but not enough to move the part.

The changes in the anterior horn cells vary from minimal abnormality to complete destruction of the neuron. By indirect evidence it seems likely that this variability of histological change is an index of the functional action of the neurons and of their recovery. To elaborate, cells may be affected in minimal fashion so as temporarily to disturb axonal conduction and their loss of function is of brief duration. They may be affected more severely with a prolonged afunctional period which exists until rather extensive regeneration occurs. Or they may be completely destroyed with no possibility of recovery.

The pathological process responsible for muscle spasm and sensitivity is still unknown. In 1916 Lovett suggested that the sensitivity might arise from the involvement of the posterior ganglia. Other suggestions have been made recently. Kabat and Knapp have suggested that it is due to the involvement of the internuncial neurons which are closely associated geographically with the anterior horn cells.[6] This is a possibility. There are others who believe that the sensitivity and spasm arise as a peripheral mechanism. Whatever the cause, the spasm present is not spasticity of the type seen in cerebral palsy and is or closely resembles reflex muscle spasm. Clinically, it has very much more in common with the type of muscle spasm that one sees with painful inflammatory lesions, such as the spasm of the abdominal muscles occurring with peritonitis or the spasm of the hamstring muscles as a protective mechanism for an infected knee joint.

For the present, we consider paralysis and spasm as separate features of the disease. They both contribute to the disability, yet spasm is a very secondary factor in its relation to the permanent disability. It is certainly not the serious feature of the disease. Spasm without paralysis is an inconsequential thing. It produces discomfort and is a factor in producing deformities in the acute stage, when combined with paralysis. Eradication of the spasm at an early stage will not prevent the paralysis, which is the main factor in permanent disability. Lessening the spasm does assist in the correction of deforming tendencies, makes the patient more comfortable, and in turn allows muscle training to be instituted at an earlier stage.

It is appreciated that in a disease which is so widespread in the central nervous system, factors other than those appreciated at this time must contribute to the picture of anterior poliomyelitis, but until further clarification in the fields of neuropathology occurs, many concepts must be theoretical. It is a field for further investigation.

### PRINCIPLES OF MUSCLE FUNCTION AS RELATED TO TREATMENT

I SHOULD like to enumerate some principles of muscle function and pathologic physiology in relation to the abnormalities which occur in infantile paralysis, at the same time illustrating their relation to principles of therapy.

1. Muscular action is inhibited by pain, sensitivity, and spasm.

2. Muscles in spasm, particularly in the presence of the muscle imbalance, produce deformity.

3. Muscles maintained for significantly long periods in a position of shortening develop myostatic contracture with fixed deformity and fibrous and facial contractures.

4. Muscles working against a deformity are inhibited in their recovery and in fact may lose power.

Let us conclude here that, in infantile paralysis, parts must not be left in the positions of deformity. Deformities must be prevented and the deforming tendencies corrected. Nursing care should emphasize attention to position, but if the desired position cannot be maintained, splints and casts are indicated for a variable period each day. Ranges of motion should be developed without inducing increased pain and spasm. Measures to decrease spasm are in order; hot packs judiciously used are helpful.

Let us consider other principles.

1. Movement of the various parts involve a complex motor pattern with which we are born and which is essentially a reflex pattern. If a muscle is left out of a particular pattern for a sufficient period, as for example from an inability to contract due to denervation, it appears that it is possible for the muscle to recover its innervation and its potentiality of contracting without resuming its activity. To make this principle directly applicable, if when a muscle is paralyzed, other muscles are allowed to substitute at all times for the action of the involved muscle, this muscle may recover its possibility of contraction, but be left out of the pattern of motion.

2. Most muscles, even those badly affected by infantile paralysis, have some neuromuscular units preserved, which act as "guiding contractile units."

The combination of these factors, namely, that muscles may be lost from the motor pattern and not resume their place even with potential ability to function, and the fact that guiding units remain in most affected muscles, is one of the important bases upon which the active exercise regimen during the convalescent stage is founded. Guided active exercises are developed avoiding substitute muscular actions and making sure that muscles which should function in the motion are the ones that do. If the patient cannot perform the motions, he is assisted. Abnormal patterns are to be avoided in the stage of recovery.

Certain other principles upon which the therapeutic regimen is based should be elaborated.

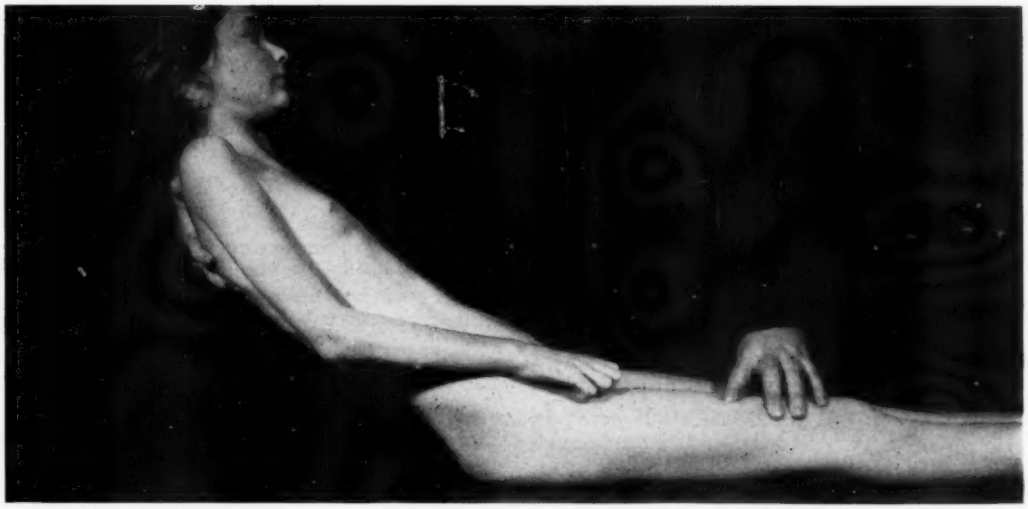

Figure 1. (Top) This illustrates marked muscle spasm in the back and in the hamstring muscles, preventing the child from going farther into the sitting position when the knees are held in extension. Spasm is an important diagnostic finding and is likewise a deforming factor.

Figure 2. (Left above) Bi-valved plaster splints, or splints of other material, are desirable in a certain percentage of cases to hold parts out of a deforming position. They are particularly useful to hold the feet and are usually used on a part-time basis. They do not interfere with other necessary therapy.

Figure 3. (Center right) Crutches are frequently desirable when walking is first started, provided the arms are normal.

Figure 4. (Lower right) Guided active motion directed toward the use of particular muscles. Muscle substitution is not allowed during the exercises of the convalescent phase.

TABLE II

MUSCLE EXAMINATION

| Grading of Muscle | Definition |
|---|---|
| O | No palpable contraction of muscle. |
| Trace | Palpable contraction of muscle, but no motion of the part which the muscle should move. |
| Poor | Muscle moves the part through its range, but not against gravity. |
| Fair | Muscle will carry part through its range of motion against gravity, but not against added resistance. |
| Good | Muscle will lift part against gravity and added resistance. |
| Normal | Normal strength. |
| In practice, certain | modified grades may be added: |
| Poor | A muscle which will move part, but not against gravity and not through a full range. |
| Fair | A muscle which will move part against gravity, but not through a full range. |

1. Muscle examination, that is, the grading of the individual muscles, can be performed and charted with sufficient accuracy to evaluate the degree of paralytic involvement. Such examinations should be performed at regular intervals to record the degree of paralysis and in turn the progress of the affected muscles. They are a great help in outlining the active exercise regimen. There is no evidence whatever that such an examination is harmful if correctly done.

2. The ability to contract muscles is related to the performance of a motion, not to an isolated contraction of an individual muscle or the thought of apposition of origin to insertion. The position in which a muscle functions best, or where a contraction may be developed in a muscle, is variable and the position for exercises should be adapted to these variables, including gravity.

3. A normal full range of motion is the best exercise for a particular muscle, provided such degree of motion can be attained painlessly.

4. Muscles which are weak are inhibited in their recovery by overactivity and overwork. Further, if a muscle cannot carry out its function satisfactorily, it may lose power. The corollary to be added is that rest in proper amounts facilitates recovery. Rest and protection are two of the important factors in treatment.

5. If the activity and work of muscles are increased on a graduated scale, they hypertrophy. In turn, if a muscle which has lost neuromuscular units permanently is stimulated to function, made to work, yet not overworked, hypertrophy of residual muscle fibers occurs.

CERTAIN other rules affecting muscle function must be mentioned.

1. Severely affected muscles may resume function to carry out a particular simple motion, and yet not necessarily be returned to a synergistic function in more complex activities, that is, to the pattern of more complicated motions. Hence, in those significantly involved, supervision of the transition to more complicated activities such as walking is indicated.

2. Only a fraction of the power of any muscle is necessary for ordinary activity. This allows an individual to perform essentially normal activities with muscles which have some degree of residual weakness, particularly if no deformities exist and training has developed the maximal functional capacities.

3. Muscle imbalance tends to be a deforming factor, particularly during the growing period. The growth and contour of bony structures is affected by paralysis and abnormal function. In this connection the comment should be

made that long-continued supervision is indicated in growing individuals who have significant residue. Exercises both to maintain maximal function and strength, and to prevent deformities, are often indicated in the chronic stage.

4. Parts used in a normal position tend to retain such position, whereas those used in deformed positions with abnormal stresses tend to increase their deformity.

5. Complete prolonged immobilization seems to interfere with the functional recovery of muscles, but there is no evidence that support used intermittently and combined with physiologic exercise is harmful. Quite the contrary, in the care of a certain percentage of patients, it is most helpful. The use of splints or casts is desirable in many cases.

One other principle which is applicable to the chronic stage should be stressed.

Once the period of muscular recovery is passed, substitute muscular actions are desirable in many cases in which significant residual paralysis exists. Hence at this stage exercises should be concerned with developing maximal function, incorporating substitute muscular actions as indicated.

We have commented that if there is significant involvement when the patient starts to stand and walk, the gait should be carefully supervised, preventing abnormal attitudes and muscular substitution. However, in the chronic stage, substitute muscular action may be allowed and encouraged as indicated to produce that gait which is most effective and least unsightly.

Crutches may be indicated at the beginning to remove abnormal stresses and facilitate the desired gait. They are rarely indicated as a permanent aid except in combination with braces. Braces may be needed to obviate deforming stresses as well as to allow practical locomotion. They do not represent a type of treatment but are used for specific indications.

## COMMENTS

As we consider these principles, it becomes obvious that someone skilled in the care of the skeletal system should be concerned with care of the patient from the very start of the disease. In usual practice this means that the patient in the acute stage should be cared for by a team composed of a pediatrician or internist and an orthopedist. Infantile paralysis is not a purely medical problem, even in the early stage, and proper care of the involved areas prevents many complications which are difficult to correct. After the acute illness, the patient should be under orthopedic supervision with medical assistance as indicated.

It seemed wiser for us to emphasize the principles upon which treatment is based, rather than to discuss the details of technique and management. There has been no sudden revolutionary change in treatment. Improvements have come by an evolutionary process.

In conclusion I should like to emphasize that treatment must be based upon sound principles. We must be alert to improve our methods, but the new must be evaluated with scientific objectiveness. Faddism should have no place in the treatment of infantile paralysis.

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# Developments in Surgery of the Upper Abdomen

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In the years before the war it was my custom to present to you some of the newer developments in the fields of surgery in which I am interested, with the idea of expressing my personal opinion of the procedures advocated in the light of my own experience and the experiences of my associates working in the same surgical fields. I shall endeavor to do so again on this occasion, but will confine my remarks to lesions of the upper part of the abdomen.

## RESECTION OF THE VAGI NERVES

*General considerations*—First of all, I should like to consider the operation of resection of the vagi nerves which my colleagues and I prefer to call "gastric neurectomy." This procedure is not new. It has been used for many years in the study of the effects of division of these nerves on gastro-intestinal motility and gastric secretion. Dragstedt has called attention to the value of the procedure in the treatment of gastric and duodenal ulcers, basing the rationale of the operation on the thesis that "the excessive secretory response of gastric glands in ulcer patients was probably due to an increased secretory tonus or irritability of the vagus nerves," and he has recently reported the results of this operation on 54 patients treated in the past three years. Fifteen of the patients required gastro-enterostomy either at the time of section of the vagi nerves, or subsequently because cicatricial pyloric stenosis had produced duodenal obstruction, contributed to in great part by the profound depression of the tonus and motility of the stomach which occurred after the operation. In determining the results of the operative procedure, Dragstedt has based his opinion on (1) the disappearance of the symptoms of ulcer, (2) the disappearance of the crater or niche of the ulcer, (3) the decrease in the quantity of nocturnal gastric secretion, (4) the decrease in the concentration of hydrochloric acid, and (5) a decrease in the motility of the empty stomach as demonstrated by the balloon technic in which contraction is recorded by utilization of the manometer and kymograph.

I have thought it best to attack the problem from the standpoint of a study of the anatomic

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NOTE: Read before the meeting of the Interstate Postgraduate Medical Association of North America, Cleveland, Ohio, October 15 to 18, 1946.

distribution of the vagi nerves in 100 cases in which necropsy was carried out (death being due to causes other than those related to ulcer). I have also attempted to repeat studies of gastric secretion (as regards quantity and concentration of hydrochloric acid) and gastrointestinal motility among patients for whom gastric neurectomy, either associated with gastro-enterostomy or gastric resection, or performed alone, has been performed. I shall confine the discussion to my own experiences in 21 of these cases.*

First of all, I have preferred to do the procedure through a transabdominal upper left rectus incision, so that I might visualize the ulcer and determine whether or not excision of it is indicated, because of suspicion that it might be either an ulcerating carcinoma of the stomach or a duodenal ulcer with impending obstruction. Therefore, in dealing with ulcerating gastric lesions, I have believed that gastric ulcer should be removed not alone for purposes of biopsy, but also because, since an incision must be made anyway, there is no reason why the entire lesion should not be removed as advocated by Balfour years ago.

If the ulcer were duodenal and it appeared as if obstruction might occur as a result of decrease in the tonicity of the stomach, then I have combined gastro-enterostomy or gastric resection with resection of the vagi nerves (gastric neurectomy). In 7 cases, resection of this nerve has been carried out without performance of any other procedure, and it is only in this latter group of cases, I believe, that the results of the operation can be evaluated, since both partial gastrectomy and gastro-enterostomy will produce a decrease in nocturnal gastric secretion, in gastrospasm and in the concentration of gastric acids. All these are, of course, results also attributed to vagotomy.

I should like to call attention to two very important points in the performance of complete division of the vagi nerves and all their branches at the level of the lower part of the esophagus, and in the determination, after the operation, that complete division actually has been achieved.

*Additional operations have been performed in similar cases by my colleagues at the Mayo Clinic.

WALTMAN WALTERS

In the first instance, anatomic dissections by my colleagues, Drs. Bradley, Small, and Wilson, have shown that in about 8 per cent of cases the vagi nerves divide into multiple branches around the esophagus just above the diaphragm, and that these branches extend through the diaphragm and terminate in this way in the stomach. It would be very difficult, regardless of whether the surgical approach was made through the thorax or through the abdomen, for the surgeon to be absolutely certain that all the branches had been divided.

Second, the insulin test as described by Hollander for determination of this point must be used with the utmost caution, because the individual response to the quantity of insulin required is variable and is dependent on many factors, which space does not permit me to

enumerate here. Suffice it to say that whenever this test is used, it must be regarded as being accompanied by the possible risk of production of hypoglycemic convulsion in some patients when the blood sugar decreases to that value which is necessary for determination of the function of the vagi nerves in respect to gastric secretion. Hence, when this test is employed, the surgeon must have a physician standing by with a syringe containing glucose and saline solution which can be injected intravenously at the slightest indication of the need for increase in the patient's blood sugar. The test itself consists of injection of 10 to 30 units of insulin in order to reduce the patient's blood sugar to 30 mg. per 100 cc. of blood. If branches of the vagi nerves are intact, an increase in the gastric secretion is regularly found forty to fifty minutes after injection of the insulin.

*Indications for resection of the vagi nerves (gastric neurectomy)*—At the Mayo Clinic we have decided to employ the procedure for patients who have recurrent ulcers after partial gastrectomy, and in some cases after gastro-enterostomy, for patients who have intractable pain caused by small gastric ulcers which have not healed under a medical regime but which have been proved to be benign, and for certain patients who have intractable pain caused by duodenal ulcers whose response to medical regime has been unsatisfactory and for whom, for one reason or another, partial gastrectomy or gastro-enterostomy does not seem to be indicated. Patients who have nonobstructive duodenal ulcer usually are young, vigorous men who have hyperactive nervous systems.

I have had 3 patients in whom paroxysmal gastro-intestinal atony developed after the operation. In 2 of these 3 patients the condition was associated with gastro-enterostomy. In one it was associated with gastric resection. Two of the 3 patients have responded to the injection of prostigmine. In a third, clinical symptoms and roentgenologic evidence indicated intestinal obstruction, but this was not found at operation; rather the entire small intestine was seen to be dilated with fluid and gas or air. There was 500 cc. of sterile straw-colored fluid within the abdomen. The patient recovered gastro-intestinal tonicity, and recovery undoubtedly was assisted by the use of an indwelling duodenal tube in which constant suction was maintained.

If the surgeon is to use the procedure of resection of the vagi nerves, I believe it important that he have a thorough understanding of the distribution of the branches of these nerves around the lower end of the esophagus, so that he may carry out a complete procedure surgically. I have described the indications which we at present are using in the selection of patients for the operative procedure at the Mayo Clinic, but it is still too early for me to comment on the results of the operation in comparison with results of such procedures as partial gastrectomy and gastro-enterostomy—for these operations have been used in many cases everywhere for twenty to forty years, and the results are well known.

## SURGICAL APPROACH TO CARCINOMA OF THE UPPER PORTION OF THE STOMACH

Since Phemister and Allen first reported on the transthoracic, transdiaphragmatic removal of lesions of the upper part of the stomach and the performance of gastro-esophageal anastomosis, 50 patients with such lesions have been operated on in such a manner at the Mayo Clinic. The method lends itself to the removal of lesions which were previously thought to be irremovable except by transabdominal total gastrectomy.

In the decision as to whether such lesions are removable I prefer, first, to make a small upper left rectus incision through the abdominal wall. This permits surgical exploration of the lesion itself and of the liver and pelvis to determine whether the lesion is operable in that it has not invaded adjacent structures, or whether hepatic metastasis or pelvic implants which would make the lesion inoperable are present. This can quickly be determined and is of much less risk to the patient than it would be if the lesion were approached primarily

through the thorax and diaphragm, only to find that it was inoperable. Moreover, the preliminary procedure I have described permits performance of the operation of total gastrectomy in which, in addition to the stomach, the avenues of lymphatic extension in the gastrocolic and gastrohepatic omentum can be excised. Experience and time, I believe, will show that prolongation of life of the patient is greater after such an operation than it is after gastroesophageal anastomosis has been carried out, for after the latter procedure, the avenues of lymphatic extension in the wall of the remaining portion of the stomach and the lymphatics in the attached gastrocolic and gastrohepatic omentum may contain malignant cells. If so, recurrence will ensue.

### GASTRIC DIVERTICULECTOMY

Gastric diverticula are rather uncommon lesions of the stomach. Because of that fact and because it has been thought that gastric diverticula produce as few symptoms as do duodenal diverticula, too little attention has been paid to these gastric lesions as possible causes of a type of dyspepsia which actually has some rather characteristic features. Gastric diverticula are located on the posterior wall of the stomach off the lesser curvature, close to the esophageal cardiac orifice. They are false diverticula in which one of the layers of the gastric wall is absent. The neck of a gastric diverticulum is small, approximately a half inch in diameter. An undistended diverticulum usually is approximately 2 to 2½ inches in diameter. Generally, the wall of a gastric diverticulum contains blood vessels; when food is retained within the diverticulum, inflammation then results and gastric bleeding of the oozing type may occur and produce marked secondary anemia.

In addition to the sign of anemia when bleeding occurs from these diverticula, there are such symptoms as a sensation of distressing fullness and pain in the epigastrium immediately after a patient has eaten. In some cases, when superficial ulceration of the gastric mucosa has occurred, ulcer-like symptoms have been present. At roentgenologic examination, performed elsewhere, of 2 of my patients, the report of "gastric ulcer" had been made. In the 6 cases in which I have operated and which I have reported in detail elsewhere, symptoms disappeared after removal of the diverticulum.

The best approach to these lesions surgically is through an upper left rectus incision. I prefer to use spinal anesthesia because it insures decrease in excursions of the diaphragm and the absence of intra-abdominal movements on the patient's respiration. The blood vessels in the gastrosplenic ligament at the fundus ventriculi are divided and ligated, the fundus is turned mesially, and then the diverticulum can be found in the location previously described. In one case—the second gastric diverticulectomy which I did—I was unable to find the diverticulum at the first operation, but found it and removed it at the second operation which was carried out some months later because of the persistence of the troublesome symptoms that I have described. After removal of the diverticulum, the symptoms completely disappeared.

### ASEPTIC VERSUS OPEN GASTROINTESTINAL ANASTOMOSIS

ALTHOUGH many types of aseptic anastomosis have been described in the performance of operations on the colon, only recently has interest been stimulated in the use of aseptic or closed anastomosis in the treatment of lesions of the stomach and duodenum. Such an anastomosis is made over clamps, which are then removed and the lumen established forcibly by approximation of the surgeon's fingers through the anastomosis. The operative technic looks better than that employed in the establishment of open anastomosis, but to my mind, the risk of bleeding from the inverted blood vessels in the submucosa of the stomach does not warrant the risk of such a procedure.

I think I can demonstrate that establishment of open anastomosis, with proper attention to surgical toilet and with irrigation of the upper

part of the abdomen and removal of accumulated blood clot, is followed by a minimal reaction. That is, I have studied the temperature charts pertaining to patients on my service who had undergone gastric operations and who were in the hospital in the middle part of July, 1946. These patients do not constitute isolated instances but were all patients who had undergone gastric operations on my service and who were in the hospital recovering from their operation on this particular day. Examination of these charts shows that, as reflected by temperature and pulse rates, there has been a minimal reaction in almost every case except one; in this one case pulmonary atelectasis developed, which, nevertheless, responded well to the usual methods of treatment. At the same time that these patients were in the hospital, there was another patient for whom I had performed ileocolostomy as the first stage of hemicolectomy on the right for an adenocarcinoma of the ileum penetrating the abdominal wall. Open anastomosis also was established in this case. An elevation in temperature of only one degree followed this operation.

It has been my experience, in the performance of open anastomosis, that even when three rows of sutures are used in the anastomosis, bleeding frequently will be seen at the posterior aspect of the anastomosis when the Doyen clamp is released. I always release this clamp before starting the first row of sutures in the anterior portion of the anastomosis and bleeding blood vessels are then ligated with a mattress suture. Blood does accumulate, however, despite this precaution.

I believe the use of warm sterile water to irrigate the upper part of the abdomen after establishment of this type of anastomosis is of tremendous value, and I should like to emphasize particularly the necessity of removal, from under the left portion of the diaphragm, of blood which accumulates during the course of operations on the stomach. In many cases, I have instilled 5 gm. of sulfanilamide in this area and under the liver, but I am convinced that the most important precautions in the reduction of postoperative reactions caused by disturbances within the abdomen are to be sure, first, that the operative field is completely avascular; second, that blood which has accumulated during the course of the operation is removed; and third, that the patient's stomach and upper part of the intestinal tract are kept empty the first three days postoperatively by means of an indwelling nasal gastric suction tube.

### USE OF VITALLIUM, RUBBER TUBES, OR CATHETERS IN ANASTOMOSIS FOR STRICTURE OF THE COMMON BILE DUCT

IT NEVER has been definitely proved that it is necessary to place a foreign-body tube of any type in the anastomosis established between the biliary and intestinal tracts to maintain patency of the anastomosis *if* a sufficient part of the common or hepatic duct is present, without inflammation in its wall, to enable the surgeon accurately to anastomose the duct to the duodenum or the jejunum. When such accurate anastomosis cannot be established, a tube must be used to provide a temporary channel for the transmission of bile and as a splint around which adjacent structures may attach themselves, to assist in the formation of an internal fistula, and to act as an uncollapsible cylinder, the lumen of which remains open unless it is obstructed by bile pigment and other debris.* Such obstruction usually occurs when a rubber tube is used and remains in place for any period, as all of you know who have removed, from a common bile duct, a T-tube which has been in place for more than a few weeks.

The necessity for maintenance of an open lumen in the tube led to Pearse's introduction of a Vitallium tube on the assumption that bile pigments would not be deposited within the lumen of the tube and obstruct it. In the first year or two that Vitallium tubes were used for

*Experience has shown that, with the passage of tubes used without accurate anastomosis between the end of the duct and the intestine, contraction of the sinus occurs, with recurrence of symptoms of obstruction.

this purpose, excellent reports were made of their value on the basis of studies over a short period after the operation. Recently, however, reports have accumulated which indicate that bile pigment does accumulate within the lumina of Vitallium tubes, and that the rigidity of the tube is not without danger in the production of pressure necrosis.

Some of the best results I have obtained in anastomosis of the common bile duct to the duodenum for the treatment of stricture have been achieved without the use of any tube in the anastomosis, but such success is possible only if an accurate anastomosis is established. When I have had to use tubes in anastomosis of the common bile duct to the duodenum, I have preferred to use the Mayo-Sullivan tube, which is a portion of a catheter about which two collars of oversize tubes are fastened. These rubber collars help to maintain the tube in place for about one week to two weeks, unless it is fastened to the duct by a nonabsorbable suture. Even when it is thus sutured, I cannot remember ever having had to remove such a tube secondarily, because all of them apparently have passed from the anastomosis through the intestinal tract.

When the stricture is small and confined to the mid-portion of the common bile duct, so that it can be excised and the ends of the duct approximated, one must not leave within the duct any sort of tube which does not have a chance to pass out of it through the sphincter of Oddi. Such an action can be assured only if a portion of the tube extends through the sphincter into the duodenum and, in such a case, the use of a catheter as recommended by McArthur in 1923 has served a very useful purpose, in my experience. To prevent natural intestinal peristalsis from pulling the tube out of the common bile duct, the tube can be maintained in position by the passing of a heavy silk suture through it, which suture is brought out through the incision and attached to the abdominal wall by tying it over a button. When it is desirable that the tube be allowed to pass out through the intestine (usually within two to three months), the suture can be removed by pulling on one of its ends.

### ANASTOMOSIS TO DUODENUM OR JEJUNUM FOR STRICTURE OF THE COMMON BILE OR HEPATIC DUCT

In discussing stricture of the common bile duct, it gives me opportunity to consider the relative merits of anastomosis of the common bile or hepatic duct to the duodenum or jejunum. It has been stated by some that anastomosis to the jejunum is the preferable procedure. When this is done, the jejunum is divided, the common bile duct is anastomosed to the distal portion of jejunum, and the proximal end of jejunum is sutured to the side of the distal portion of jejunum, as is done in the Roux type of gastro-enterostomy. This procedure is based on the opinion that, since air can be demonstrated as being present within the intrahepatic ducts after the common bile duct has been anastomosed to the duodenum, and that since barium administered by mouth can be demonstrated as entering these ducts, reflux of gas or liquids into these ducts is responsible for the episodes of fever, jaundice, and pain which occur in some cases subsequent to performance of biliary-intestinal anastomosis in the treatment of stricture.

In my opinion, however, these symptoms actually are those of obstruction at the site of anastomosis; I believe that they arise because of this obstruction, and that cholangitis is secondary to this obstruction. I think that such symptoms will be found to occur also among those patients who have undergone the Roux type of biliary-jejunal anastomosis, if obstruction occurs at the site of anastomosis. Moreover, the presence of air likewise can be demonstrated within the hepatic ducts after performance of biliary-jejunal anastomosis. In other words, in my opinion, the disturbance of hepatic function characterized clinically in most cases by pain, and in others by fever or jaundice, subsequent to performance of biliary-intestinal anastomosis, is the result of stasis within the biliary tract secondary to incomplete

obstruction at the site of anastomosis, and is not the result of reflux of gas or liquids up into the common bile and hepatic ducts.

I think this point is worthy of emphasis, because for the very seriously sick, jaundiced patient who has disturbance of hepatic and renal function associated with stricture of the common bile duct, the simplest and safest type of operation which will relieve the obstruction is anastomosis of the cut ends of the duct, if the stricture can be excised. If the stricture is too extensive or involves the lower end of the duct, the alternative is anastomosis of the duct above the stricture to the duodenum. When I recently mentioned this point to a visiting French surgeon, Dr. Robert Soupoult, he said that he had studied the same problems experimentally in dogs, and was able to demonstrate specifically that cholangitis was not produced by the reflux of gas or fluid up the common bile duct and hepatic duct, where the effect of the sphincter of Oddi was lacking as in a biliary-duodenal anastomosis, but that it was produced by obstruction at the site of anastomosis.

### NEOPLASMS OF THE ISLANDS OF LANGERHANS

I SHOULD like to close this consideration of some of the advances in the treatment of lesions of the upper part of the abdomen by referring to some of the problems associated with hyperfunctioning adenomas of the islands of Langerhans of the pancreas. These adenomas produce paroxysmal hypoglycemia. I am sure that all physicians are acquainted with the clinical syndrome which appears as a result of hyperinsulinism. The patient's blood sugar decreases to lower than 40 mg. per 100 cc. of blood. The patient becomes drowsy and frequently may lose consciousness. Some patients in whom this has occurred actually have been arrested by the police because of suspected alcoholic or drug intoxication. Frequently, neurologic symptoms have developed during the hypoglycemic episodes and in some cases, the patients have become so unusual in their reactions that they have been judged to be insane.

Space does not permit a discussion of the detailed metabolic studies necessary to exclude other causes for the paroxysmal hypoglycemia. I should, however, like to refer to the position of the hyperfunctioning adenomas in the pancreas and some of the difficulties which I have encountered in determining the presence of these tumors. Since they vary from a few millimeters to more than 2 cm. in diameter, it can be readily understood how the smaller tumors might escape detection, especially those located in the substance of the gland.

I have found that the best approach to the pancreas is through the gastrocolic omentum; the stomach is reflected upward and the pancreas is exposed for visual inspection and manual palpation. The sites at which the tumor most frequently is likely to be overlooked are the head and tail of the pancreas and the undersurface of the pancreas. If the pancreas is picked up between the surgeon's thumb and finger in such a way that he can palpate it anteriorly and posteriorly, even small adenomas can be palpated.

The small tumors in the substance of the pancreas, and especially those in the head of the pancreas, often may escape detection if any means other than removal and serial section of the pancreas is employed. It is our custom, therefore, when an adenoma is not palpated, to do subtotal pancreatectomy in which all but the head of the pancreas is removed. Removal of the spleen and splenic vessels facilitates this procedure. It can be readily seen that if all of the pancreas except the head is removed, there is probably an 80 per cent chance that any tumor of the pancreas that had been present also is removed, since in about 20 per cent of cases the adenoma is located in the head. If, after this procedure, the patient continues to have symptoms, the head of the pancreas should be removed.

As is true when hyperfunctioning tumors of the ductless glands are removed, an overcompensation in the opposite direction occurs, and must be compensated for. For example, when

a hyperfunctioning adenoma of the islands of Langerhans producing hyperinsulinism occurs, removal of it produces temporary hypo-insulinism with high values for blood sugar which may require the administration of insulin for correction.

SUMMARY

The significance of anatomic dissections of the vagi nerves of 100 human beings and a study of resection of the vagi nerves in the treatment of peptic ulcer have been considered. The present indications for the use of this procedure have been enumerated.

Transabdominal exploration of lesions of the upper half or two-thirds of the stomach would seem to be preferable to transthoracic and transdiaphragmatic exploration. Gastric diverticula, although rare, produce a characteristic group of symptoms which are relieved by the removal of the diverticula. The open type of gastro-intestinal anastomosis is preferable to the closed, so-called aseptic method, for it allows complete hemostasis and is followed by a minimal post-operative reaction, especially when the upper part of the abdomen is irrigated with water, and blood is removed from under the left side of the diaphragm. No tubes of any sort are required if an accurate anastomosis can be made of the common bile duct above the site of stricture to an opening in the duodenum. The use of a piece of rubber tube or a catheter as a temporary "scaffolding" in such an anastomosis is preferred to the use of a vitallium tube. If that portion of the common bile duct affected by stricture cannot be excised and the ends of the duct approximated, anastomosis of the common or hepatic duct to the duodenum is preferred to anastomosis of these ducts to the jejunum. Although most hyperfunctioning adenomas of the island of Langerhans are palpable, some are not. Whenever one thinks that such lesions may be present, but they cannot be palpated, then subtotal pancreatectomy is advisable in the hope that the adenoma will be found in the substance of the removed portion of pancreas.

## MILIARY TUBERCULOSIS

Miliary tuberculosis and tuberculous meningitis are two of the most fulminating and fatal forms of tuberculosis. Because of that fact, investigators at the Mayo Clinic selected 5 such cases upon which they could study the action of streptomycin. Although all the patients died, the effect of the antibiotic on the progress of the disease was evident.

Streptomycin caused a regression and healing of the miliary tubercles in the lung, choroid layer of the eye, liver, and spleen. Tuberculous meningitis was inhibited in its development in one patient and prevented or cured in two others. Except for renal tubular damage in one patient, no toxic effects were observed. Because of the gravity of the prognosis in these types of tuberculosis, the results are regarded as distinctly encouraging.

# The Operative Treatment of Aneurysms and Arteriovenous Fistulas

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Accounts of injuries to blood vessels in warfare have been recorded since the beginning of history, and the attention of surgeons has of necessity been primarily directed toward their treatment because of their often fatal nature.

The number of such injuries has increased steadily, probably because of the introduction of higher velocity projectiles of smaller caliber. The fragments of these exploding missiles may produce as many as two hundred small individual wounds scattered over the body without causing death and thus increasing the chance of trauma to blood vessels.

This report is concerned with the operative treatment of traumatic aneurysms and arteriovenous fistulas, approximately 500 of which were treated at the vascular surgery center of an Army general hospital over a period of three years.

If a vessel is only partially severed, the wound tends to enlarge in the long axis of the vessel owing to retraction, and hemorrhage is apt to be profuse. If the wound in the soft tissues overlying the vessel is large, hemorrhage, of course, would be external and probably would require medical control. But if the wound is small, the overlapping of the various muscle, fascial, and skin planes may prevent the escape of blood externally. This results in a hematoma which may become a false aneurysm.

However, in instances with a small external wound, when the vein is injured at the same time, an arteriovenous fistula may result, the artery and vein communicating directly or through the medium of a false sac. In either case it is well to remember that some blood continues to flow through the distal portion of the artery, thus nourishing the part beyond, and that collaterals develop rapidly. Therefore, immediate operation is always contraindicated unless necessitated by hemorrhage or rapid enlargement of an aneurysmal sac which compresses the vessels of this collateral circulation.

Openings in blood vessels produced by small missiles may for a time produce no symptoms. For this reason, these lesions are frequently overlooked, particularly if more striking or extensive injuries are present. Aneurysms of various types will be overlooked unless every wound is carefully examined, particularly by auscultation.

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NOTE: Presented before the meeting of the Interstate Postgraduate Medical Association of North America, Cleveland, Ohio, October 15 to 18, 1946.

The differentiation of a false arterial aneurysm from an arteriovenous fistula is extremely important, since the sequelae, the general and local effects, as well as the treatment of the two conditions, vary greatly. The differential diagnosis is not always easy, but as a rule the arteriovenous communication is characterized by continuous vibratory thrill and a loud, rough, continuous murmur with systolic intensification, whereas in the false aneurysm there is distinct pause between the systolic and diastolic phases, and more often the murmur is heard only in systole.

In the 500 instances of aneurysms and fistulas, approximately 100 were the false traumatic arterial type and the remainder were arteriovenous fistulas. Since anatomically they presented many of the same problems, they will be discussed together. They were encountered in practically every named blood vessel in the body, with the exception of the aorta, and many presented varied problems of approach and treatment.

In the case of a partial division of an artery resulting in a false aneurysm, the treatment followed was generally according to the Matas' principle of opening the sac under a tourniquet if possible, locating the openings within the sac and suturing within the sac. Where nerve injuries were present and a neurolysis or nerve suture had to be done at the same time, this method could not be used.

The principal method of treatment of arteriovenous fistulas was quadruple ligation and complete excision of the lesion. Although it is recognized that repair of the artery by one means or another is preferable, it usually cannot be done because of scar tissue.

I SHOULD like to stress the fact that proximal ligation of the artery should not be done as a means of treatment as gangrene is apt to follow, the fistula is not cured but is still being fed through collaterals, and what blood might go through the distal artery is cut off. Likewise, proximal ligation of artery and vein will not cure the condition—since the fistula is still present—nor will ligation of all the main vessels cure it if there are any communicating vessels or collaterals left. Therefore, complete excision is certainly the method of choice, and the circulation, if time is allowed for these collaterals to develop, will usually be improved.

If complete excision is done, an important technical point must be stressed — the artery proximal to the fistula should first be isolated but not ligated. If it is ligated, it is more difficult to locate the fistula. After location of the proximal artery and its isolation, the distal artery and vein may be ligated and divided; then the proximal artery may be ligated and divided; and finally, as the last step in the procedure, the collateral vessels, with the proximal vein, may be divided. In repairing arteriovenous fistulas this can sometimes be done, usually with sacrifice of the vein, with removal of a portion of the vein and an actual suture of the artery. Or, many times the vein itself may be utilized but sacrificed, and the opening between artery and vein approached transvenously, using the remaining portion of the vein to reinforce the sutures.

Excisions of arteriovenous fistulas, of course, must eventually be done if they are of any size, because of the strain on the heart due to increased cardiac output resulting from the shunting of blood through the fistula.

Not infrequently aneurysms of this kind on the scalp become cirsoid with multiple communications, and the following method of treatment is advocated: First, ligation of all main vessels, such as the superficial temporals or even both external carotids, the turning down of a scalp flap, going completely through the galea to the pericranium, the turning back of such a flap and the dissecting out of the communicating vessels by going through the galea from the underneath side. Large arteriovenous fistulas of this type are particularly difficult because of the inability to control bleeding, no tourniquet, of course, being possible.

Twelve instances of arteriovenous fistula have been encountered in the vertebral vessels. They are by far the most difficult to reach in the

neck, since the vertebral artery runs through the foramina and the transverse processes of the upper seven cervical vertebrae. In its lower portion the fistula is best approached through the sternomastoid muscle, displacing the carotid vessel anteriorly and then reaching the vertebral vessels by removing the transverse processes of the atlas and axis. They may have to be removed in order to reach the vessels themselves.

We have not hesitated at any time to remove the clavicle in order better to expose lesions of the lower carotid vessels or the subclavian or even the axillary in the first portion. If the clavicle is removed subperiosteally there is little danger of injuring underlying structures unless an aneurysm be present which actually has its wall formed by the clavicle. We believe it is unwise to replace removed portions of the clavicle because it is not needed for any particular function and if replaced, painful union is apt to occur.

After removal of a portion of the clavicle, the incision may be extended upward to expose the lower carotid and first portions of the subclavian vessels. Section of part of the sternomastoid muscle exposes the vertebral vessels, thyrocervical trunk, and subclavian vessels. Additional exposure is had by cutting the tendon of the anterior scalene muscle which overlies the subclavian artery.

The iliacs, internal, common, and external, are best approached through a retroperitoneal incision, much as one would approach surgically the lower ureter. The gluteal vessels are approached directly through the buttocks, but after preliminary ligation, either complete or temporary, of the common iliac artery through a retroperitoneal incision.

The femoral vessels in the thigh are best approached along the sartorius muscle and, if necessary, preliminary ligations may be made through a transverse incision at or below or just above Poupart's ligament. In the lower femoral and upper popliteal vessels, an incision posterior to the quadriceps is done, but with the knee flexed and externally rotated. When the deep fascia is opened, the sartorius muscle retracts posteriorly and exposes Hunter's canal in its lowest portion.

It is important, I think, in approaching any blood vessel or making any incision, not to cross skin folds transversely. An S-shaped incision, particularly in the popliteal space, is by far preferable to one which is transverse. The same is, of course, applicable to crossing skin folds either in the neck or in the cubital fossa.

We have done a number of operations in which we felt it was necessary to remove the upper portion of the fibula, including the head, in order to reach the posterior tibial, the anterior tibial, and peroneal vessels. Unless that is done, uncontrollable hemorrhage may be encountered because of retraction of the vessels through the interosseous spaces. We have not felt, and I am sure most orthopedic surgeons will agree, that it is not necessary to replace the upper end of the fibula. There is no instability of the knee following such a procedure. The important point is to isolate the peroneal nerve completely to prevent any possibility of injuring it, and to remove the bone subperiosteally, usually at the head, by sharp dissection. This is done in the lower end by use of a Gigli saw. When this procedure is followed, the upper portions of the posterior and anterior tibial and peroneal vessels are immediately exposed by the muscles.

For incisions lower down, of course, it is not necessary to remove any bone, but the posterior tibial vessels and peroneal vessels are approached through an incision exactly one finger-breadth behind the posterior border of the tibia, through an incision which may be extended a little further up or down as far as the internal malleolus.

For approach to the plantar vessels, incision is made on the inner side of the foot and not on the weight-bearing sole of the foot, since such scars are usually painful. The abductor hallucis is detached and the incision is made following the long tendon into the sole of the foot between the short flexors where the plantar arch is easily exposed.

Operations which we have performed on the lower extremities were done almost entirely under continuous spinal anesthesia. Operations on other parts of the body were usually done under pentothal sodium supplemented by nitrous oxide and oxygen. There were no complications of consequence attributable to the anesthetic.

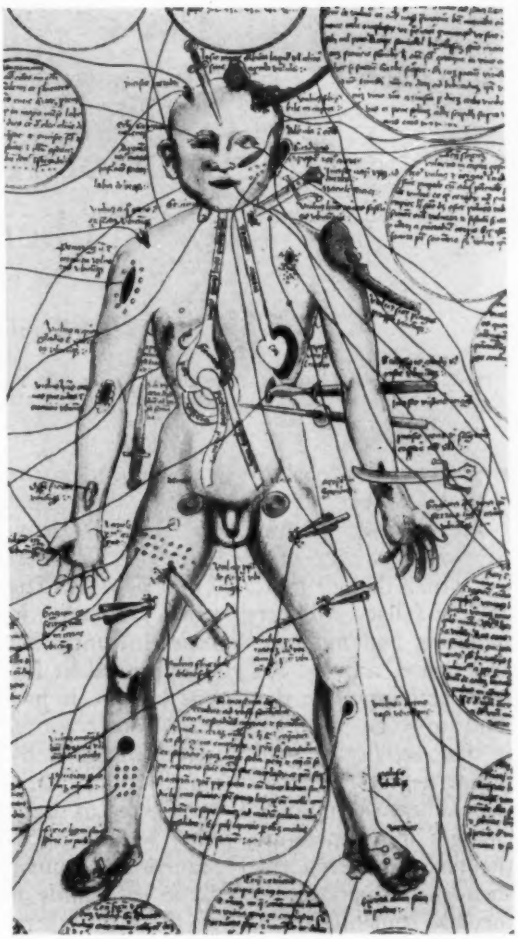
All together, half the operations performed required more than three hours and some as much as seven hours.

There were no instances of gangrene of an extremity in this series. Sympathectomy and sympathetic block were rarely performed either before or after operation, although the advantages of it are thoroughly appreciated.

The time interval between the origin of the wounds and the operation averaged three months, and it was rarely less. Thus, ample time for the development of collaterals was allowed. Had operations of necessity been performed at an earlier date, no doubt sympathetic interruption would have been more frequently performed.

There was but one death in this series and that was due to a secondary hemorrhage following excision of an arteriovenous aneurysm of the subclavian vessels. The fistula was so close to the aorta that the vessels could not be transfixed, a procedure always carried out in operating upon vessels of any size. There were two instances of cerebral anemia with paralysis following operation on the carotid vessels. One of these was transient, the other permanent.

In 10 patients, more than 1 operation was necessary to effect a cure. In 2 of these cases, 4 operations were performed. Three patients were not cured by operation—all of them had arteriovenous fistulas of internal carotid vessels at the base of the skull which could not be completely eradicated because of their position.



The Wound-Man. This mnemonic figure illustrates the various possible injuries to which the human body was supposed to be subject. About A. D. 1500. Reproduced from "The Fasciculus Medicine" of Johannes de Ketham, Alemanus, Facsimile of the First (Venetian) Edition of 1491.

DIAGNOSTIC CLINIC

# The Diagnosis of Activity in Pulmonary Tuberculosis

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THERE is probably no single word in the vocabulary of clinical tuberculosis more widely employed than the word "activity," and no concept more widely misunderstood than the one indicated by that word. The ancient fallacy still persists that rales arise in moisture, and moisture signifies inflammation and hence, activity. An equally prevalent fallacy, perhaps more dangerous because it pretends to be based on more precise observations, is that activity is generally accompanied by some degree of constitutional disturbance, which, however mild, will be reflected in slight changes in temperature, pulse, weight, appetite, physical energy, etc. I frequently encounter such misconceptions, not only in the minds of medical students but also in those of experienced practitioners and skilled internists.

There has probably never been a period when a clear understanding of the subject of activity in tuberculosis was quite as important as it is today. The introduction of the miniature film technique, and its use by the military services, and in industrial surveys, have made the public "chest x-ray conscious" to an unprecedented degree. It has been the general experience that two-thirds to three-fourths of all cases of tuberculosis discovered in mass x-ray surveys of apparently healthy groups of our population are neither obviously active nor obviously healed, but belong to that large in-between group which requires study and observation to determine the presence or absence of activity.

First, what do we mean by activity? The word obviously implies a disease process which is undergoing a change in its status as opposed to one which is stationary. But this definition is neither accurate nor sufficiently comprehensive. A change in status may be, in some cases, merely a histological change, having no immediate clinical significance. For example, it is entirely possible to have very gradual caseation going on in the center of a well-encapsulated focus, either in a lymph node or in the lung parenchyma, over a period of years during which the subject remains in good health. We must, therefore, recognize the possibility of *pathological* activity, or change, without *clinical* activity.

Changes may also occur in either of two directions, the progressive or the retrogressive. Retrogressive change may or may not have clinical significance, depending upon whether the observed retrogression occurs near the beginning or near the end of the healing process.

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NOTE: Presented before the meeting of the Interstate Postgraduate Medical Association of North America, Cleveland, Ohio, October 15 to 18, 1946.

Furthermore, we often encounter cases in which the disease, though not healed, remains stationary for varying periods of time before resuming its progression. Therefore, if we wish a concept of clinical activity which is synonymous with need for treatment it must include three distinct groups of cases—first, those showing anatomic progression; second, those which are anatomically stationary but not healed; and third, those which are retrogressive but not yet safely healed.

RAYMOND C. McKAY

As AIDS in determining whether or not a case requires treatment, the symptoms, physical signs, laboratory data, and x-ray picture may all be used—or misused. The *symptoms* of pulmonary tuberculosis are familiar to all of you. For convenience they are often divided into two groups: the local symptoms, consisting of cough, expectoration, hemoptysis, and pleuritic pain; and the constitutional symptoms, consisting of fever, tachycardia, night sweats, dyspepsia, loss of weight, and loss of strength. The late Dr. Lawrason Brown long ago pointed out that generally speaking the local symptoms were more useful in establishing the *presence* of the disease, while the constitutional symptoms were more significant as indicators of *activity*. No one of the symptoms is peculiar to tuberculosis. When only one or two of them are present they may often be due to some other cause, and erroneously attributed to the minimal lesion shown in the x-ray film. The only safeguard against this error, if one has not had sufficient experience in evaluating the symptoms, is to rely upon serial x-ray films as the best guide. When a number of the familiar symptoms are present, and particularly the constitutional symptoms, the activity of the disease is usually so obvious that it is not a problem.

The more common and by far the more serious error, however, is to exclude activity because of the absence of all symptoms. It cannot be emphasized too strongly that tuberculosis, both in its onset, and during the early period of a relapse, is characteristically a symptom-free disease. We dare not depend upon symptoms, or await the development of symptoms, to confirm the presence of activity. To do so is to lose the most favorable moment for treatment. Two national surveys have shown that when the diagnosis is based upon symptoms, 87 per cent of the cases will have developed advanced disease. With few exceptions the beginning of symptoms indicates a stage of acute progression occurring several months after the actual onset of activity. It has been a very discouraging experience to see an increasing number of our hospital beds filled with patients whose symptom-free, early disease was discovered in an industrial survey or an army induction examination a year or so earlier, but who refused treatment and continued to work until they felt sick and had advanced disease. Our public requires a large dose of education in this matter; let us hope that most of it will be forthcoming from physicians rather than be left to lay organizations and life insurance companies.

PHYSICAL signs are of still less value than symptoms in the determination of activity. Inspection, palpation, and percussion are entirely worthless, and auscultation is not much better. Coarse, or moderately coarse, moist rales, when present, do usually indicate activity, but they are rarely present in cases in which activity is a problem, and they are often absent, even in far-advanced disease. Conversely, rales of the fine, or moderately coarse, dry type are often present throughout the entire life of a person with well-healed tuberculosis.

Like symptoms and physical signs, the laboratory helps us out occasionally by confirming a suspicion of activity, but is undependable for the purpose of excluding it. The finding of tubercle bacilli in the sputum, or in the gastric contents of patients who have no sputum, is always an indication for treatment, and the search should never be neglected in questionable cases. The sedimentation rate is usually elevated in frankly active cases in which its help is not needed, but its failure to reflect lesser degrees of activity and its frequent elevation from other causes make it of very limited value in pulmonary tuberculosis.

A great amount of work has been done in correlating the differential cell count of the blood with the type of pathological reaction which prevails in the tuberculous process; it is well established that a close correlation exists. Those who have done research on the subject are naturally enthusiastic about it, and they continue to urge blood studies as a guide both to activity and to prognosis. Blood studies, however, are of little use to the doctor in practice. They require skilled technical assistance, and a degree of expertness in interpretation which is not generally available. Even more serious limitations are that the changes are not specific for tuberculosis, and thus far it has not been shown that they precede the anatomic changes. For these reasons the consensus among clinicians is that the x-ray picture still remains a more accurate, sensitive, and dependable barometer of intrapulmonic weather than is the blood picture.

The very great superiority of the x-ray film over all other guides to activity in pulmonary tuberculosis makes it all the more important that we recognize its limitations, which, fortunately, are minor, and learn to use it to the greatest advantage. It requires comparatively little experience for anyone to learn to recognize, on the one hand, the extreme type of so-called "soft" shadows, with indistinct borders, which signify the active, exudative, pathological reaction, and, on the other hand, the so-called "hard" shadows, partly or largely linear in configuration, and with sharply defined borders, which signify a well-healed fibrotic reaction. In between these two extremes is a large group of cases in which the most experienced and expert interpreter will be unable to differentiate active from inactive disease by a single film. In these cases there is no substitute for the careful and detailed comparison of serial films made at intervals of one to three months. In making such comparisons it is important to keep in mind the following points.

If one of the comparison films has received a heavier, and the other a lighter, exposure, the latter will give the illusion of a general increase of the disease. This can be checked by comparing the shadows cast by the normal structures. Then one should look for any localized changes, which are greater in degree than those generalized changes shown in both the normal and diseased areas.

Accurate comparison also requires that the lungs be inflated to the same degree in the two films. Poorly inflated lungs, even if normal, will appear to be diseased in comparison with better inflated ones, and any disease in them will cast exaggerated shadows. The depth of inspiration is easily checked by counting the posterior ribs down to the dome of the diaphragm. The mechanical effect of under-inflation is even more deceptive when it occurs on one side only. This is often caused by such things as pleural thickening, even when of slight degree, by a quantity of air or fluid in the pleural cavity, by paralysis of one diaphragm, or by displacement of the mediastinum from any cause.

Another factor which very often causes difficulty is slight rotation of the patient, either

Figure 1

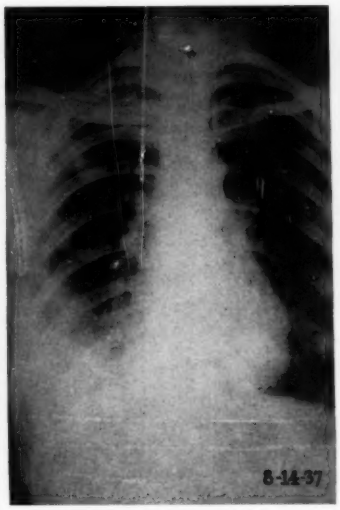


Figure 2

Figure 3

to the right or to the left. This obviously presents the disease structure in a different sectional plane and may alter its contour. The presence and degree of rotation are easily checked by comparing the position of the medial ends of the clavicles with relation to the spine.

Perhaps the most common source of error in comparing films is failure of the interpreter to take account of the differences in the angle at which the rays coming from the tube impinge upon the chest. This is rarely, if ever, sufficient in degree to make significant changes in the contour of the shadows, but it very often changes the position of *disease* shadows with relation to the *rib* shadows. In exceptional cases the entire shadow of an early, active focus of tuberculosis can, in one film, be concealed behind a rib, and in another be clearly silhouetted against an interspace. This explains the familiar observation that at least half of the value of stereoscopic films comes not from viewing them stereoscopically, but from the comparison of two images made at different projection angles. In this respect the clavicle is of even greater importance than the ribs, since its position with relation to any portion of adjacent lung can be changed not only by the projection angle, but by the position of the patient's highly mobile shoulders. Thus, a slight change in the position of the clavicle will often give the illusion of progressive disease by revealing more fully shadows which were partially concealed, or vice versa.

To illustrate these points the following cases, and the accompanying films, are presented.

*Case one*—In Figure 1 it is easy to see the disease in the top of the right lung field above and below the clavicle. This nurse had an acute sinusitis, and because of a little cough, an x-ray examination was made, and this disease was discovered. We were uncertain about the activity, but the shadows showed none of the very hard or linear characteristics of healed disease; on the other hand, they were well defined and did not have the fuzzy borders which characterize acute disease.

Serial films were made, first at intervals of two to three months, and later once or twice a year for a period of six years, during which time she remained in continuous good health. Then she developed this obvious relapse with a little fresh disease and a small pleural effusion at the base (Figure 2). A year of bed rest fol-

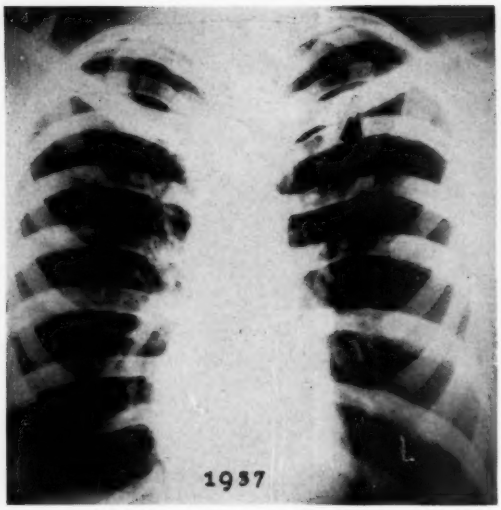


Figure 4

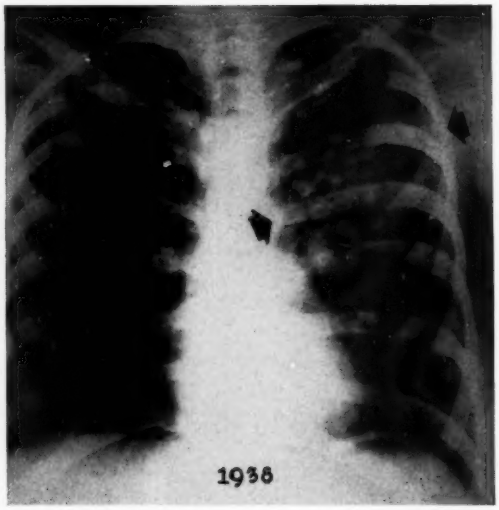


Figure 5

lowed, at the end of which there was not only resolution of the increased disease, but there was also resolution of much of the original disease as is shown in Figure 3.

This case illustrates one phase of the problem of activity which is very important and which is probably the least well understood, namely, the capacity of tuberculosis to remain for an indefinite period of time entirely unhealed but not progressive, in what might be described as a state of suspended animation. For such a condition to persist as long as in this case—six years—is unusual, but periods of from several months up to one or two years are fairly common.

Although no particular harm resulted to this girl from the delay in treatment, one could have anticipated the final event by asking oneself at the outset not whether these were the shadows of active disease, but whether they were the shadows of healed disease. By reversing the question in that way I think it is more easily answered from the original film.

*Case two*—Figure 4 shows very slight tuberculosis under the first rib, dipping down into the interspace. If you have any difficulty in seeing it, compare the opposite interspace and note that it is definitely clearer. We had previous films showing the absence of these shadows, and for that reason only we knew that it represented active disease.

Treatment was advised, but the girl was absolutely symptom-free and felt herself to be perfectly well; she refused advice and went her way. One year later a film showed the widespread, far-advanced bilateral disease that is revealed in Figure 5.

I have seen this same sort of experience very many times in men whose disease was discovered in industrial surveys and in induction center examinations, and who refused treatment until it was too late, because they felt perfectly well and were not disposed to alter their way of life because of some mere x-ray shadows.

*Case three*—This represents the more chronic type of case in which the determination of activity may be still more difficult. This patient also had no symptoms. This was a pre-employment examination in an industrial plant. The film showed the character of the shadows in both apices to be rather typically hard, representing a predominantly fibrotic reaction. We, at first, were at a loss to know for certain

Figure 6

Figure 7

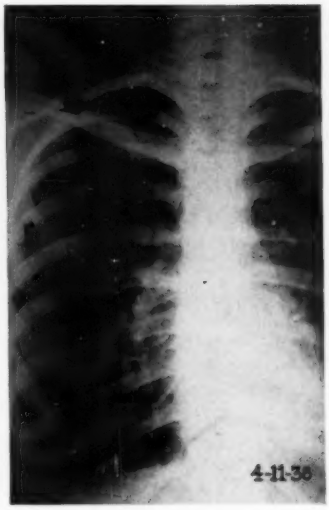


Figure 8

whether or not the fibrosis was covering up some smouldering activity. In this case the laboratory helped out, and repeated sputum examinations finally revealed tubercle bacilli. In similar problems sputum examination often provides the quickest solution, but if it remains negative one must depend upon serial films.

*Case four*—Figure 6 shows obvious slight mottling in the first interspace as indicated. The patient was given about five months of bed rest. In Figure 7 it can be seen that the shadows have largely but not completely disappeared—very gratifying x-ray improvement for that period of time. Since the patient had had no symptoms at any time she was mistakenly allowed to return to work following this film.

Figure 8, taken several months later, reveals a residue of the original disease and also the relapse. In this case, the early x-ray improvement was misleading. Experience has shown that such early active lesions treated by rest usually require at least a full year of rest, no matter how conspicuous the x-ray clearing of the shadows may be during the first few months.

*Case five*—This patient had had a typical cigarette cough for a number of years and recently she noticed that the character of her cough had become a little different, and a small amount of thicker sputum than she had ever raised before made its appearance. Her alert doctor promptly ordered a film which showed every appearance of well-healed disease, but the sputum examination showed bacilli. The problem was to reconcile the shadows of apparently healed disease with the presence of tubercle bacilli. Stereoscopic films in two good hospitals failed to show any evidence of cavity, and the source of the positive sputum remained a mystery, although several good roentgenologists and a number of experienced clinicians viewed those films.

In cases like this, resort to some one of the special x-ray views is often of great help. There is a variety of such special views—obliques, laterals, the heavy penetration made with the Bucky-Potter diaphragm, stereoscopic films, laminagrams, and so on. One which is perhaps least often used and which we have found valuable in tuberculosis is the so-called lordotic view in which the patient is made to lean sharply backward. This gets the clavicles completely out of the way and widens the interspaces in the upper part of the chest. With the lordotic view in this case, a 2-cm. cavity in this

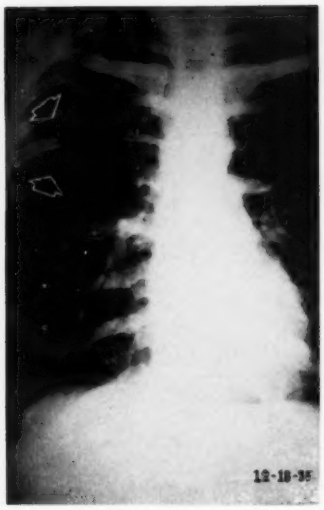

Figure 9

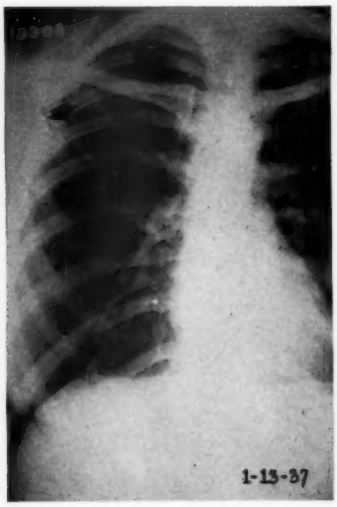


Figure 10

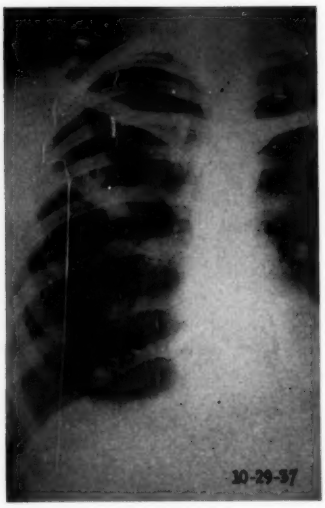


Figure 11

area was clearly outlined, making the source of the positive sputum quite apparent.

*Case six*—Figure 9 shows a very slight shadow in the area marked. Something over a year later the shadow appeared unchanged as is shown in Figure 10. It is a little farther removed from the rib in this film and its silhouette is more sharply defined. It has all of the superficial appearance of an inactive and healed, or at least partially healed, lesion.

Five months after that last film, another serial film (Figure 11) revealed an acute flare-up of the disease. This was discovered before the patient had any symptoms. She was still in perfect health. Ordinarily one would expect symptoms to make their first appearance soon after the disease process reached this degree, but this case again illustrates the great importance of serial films.

*Case seven*—The problem of activity in tuberculosis becomes infinitely more difficult when it is complicated by the presence of silicosis. We repeatedly see the well-known conglomerate shadows of silicosis which, as many of you doubtless know, often represent only old obsolete infection. On the other hand, we often see similar shadows so disposed, extending out to the periphery or with indistinct borders, as to make us suspect that there is latent or smouldering tuberculosis in the background.

In this case films were made several months apart. We thought the second film showed slight but definite progression of the shadows. The silicotic nodulation was also distributed through the lung fields. This patient, an old moulder, was advised at that time, in 1935, that he probably had complicating tuberculosis. However, he felt well and against advice went back to work at his job of moulding.

Ten years later he was admitted to the hospital with advanced tuberculosis with large cavities in both apices. Ten years is an exceptionally long period of time, but over and over again in silicotics we see the warning signs of smouldering tuberculosis which does not develop into frank clinical activity with symptoms for periods of one, two, and three years.

DIAGNOSTIC CLINIC

# Carcinoma of the Colon

THOMAS E. JONES

THE CLEVELAND CLINIC, CLEVELAND

MALIGNANCIES of the colon still are a tremendous job. The job can be made a little easier for the surgeon if an earlier diagnosis is made.

I want to devote most of this paper to the early diagnosis of carcinoma of the colon and rectum. One thing must be realized: from an anatomical standpoint the surgeon has gone just about as far as he possibly can in the eradication of malignant disease of the colon. The kidneys have been removed with the growth, parts of the stomach have been removed with the transverse colon, the spleen, uterus, and adnexa as well as parts of the bladder have all been removed. We cannot go any further from an anatomical standpoint. Future results are dependent entirely upon early diagnosis; that, of course, rests squarely upon the practitioner, whether he is a surgeon or a medical man. The surgeon knows very well at the time of operation what a tragedy it is when he fits into the picture the history that the patient has had symptoms for six months, nine months, a year, or even longer, without adequate investigation. Those are the sins of omission, of course, and not the sins of commission.

NOTE: Presented before the meeting of the Interstate Postgraduate Medical Association of North America, Cleveland, Ohio, October 15 to 18, 1946.

Frequently we are asked, "What are the symptoms? How can you find out when a person has an early carcinoma of the colon?" Those are very difficult questions to answer. Unfortunately, there is no characteristic syndrome or any group of symptoms whatsoever for carcinoma of the colon. The symptoms vary greatly for the reason that the colon is different anatomically and physiologically in its various segments.

I think the greatest pitfall in diagnosis is, very simply, that the physician ordinarily associates cancer of the colon with obstruction. Probably that goes back to his intern days when he had to get up in the middle of the night to operate upon an acute obstruction, and after the patient died, he found it was cancer of the colon. That lingers long in his memory—that cancer is a growth which obstructs the lumen. Of course that is not entirely true. On the right side of the colon, the cecum, and ascending colon, the lumen is very large anatomically. Embryologically it rises from the midgut. Its function is entirely different from that on the left side. It is where the absorption takes place. The growths are flat and ordinarily there is no obstruction whatsoever because the contents are liquid on the right side of the

colon. Only occasionally do you get some obstruction as a first symptom on the right side, and in those, only where the ileocecal valve is definitely involved. In the right side of the colon that is a very rare condition.

The symptoms of a neoplasm on the right side are those of a physiological nature. The patient will have digestive symptoms, a vague epigastric discomfort, perhaps something like a chronic appendix. The patient loses weight because something has happened to interfere with normal absorption. There is generally a marked anemia with lesions on the right side of the colon, owing to the lack of absorption of various foods. These patients go on being treated for anemia for months and months before the diagnosis is actually made. They are treated with liver, iron, and all sorts of things without improvement, and finally an investigation is made, and the disease is disclosed.

On the left side of the colon the lumen of the bowel is smaller, the muscular coat is thicker, and the stool is firm; therefore we are more apt to get obstructive symptoms earlier than on the right side. Anemia is not so prominent with lesions of the left side unless there is definite metastasis or liver involvement. Trauma will cause some bleeding and mucus from a neoplasm in the left side of the colon.

In the next group, relating to the rectum, diarrhea is a very prominent symptom, and this again throws one off. We have gone through various periods of different treatment for diarrhea in the past twenty years. These patients used to be treated with vaccines and serums for colitis. When that treatment failed to cure even colitis, let alone cancer, we got tired of it. Then another very popular agent came along, the sulfa drugs, and now all these patients I find have been given a course of sulfasuxidine and all the other sulfa drugs for many weeks or months before the real diagnosis is made. This is because the patient has mucus, diarrhea, and blood. But it is a false diarrhea, not a true diarrhea.

I have often said that the pediatrician makes all of his diagnoses of gastro-intestinal complaints by looking at the stools. If the physician would look at one of these so-called diarrheal stools in adults, he would know very well that it was not a true diarrhea but a false one, the stools being frequent emissions of mucus, pus, and blood.

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THE diagnosis of any of these cases must be made in a methodical manner, and unless it is done in a methodical manner, there will be errors. The first and most important procedure is an accurate sequential history. Anybody who comes in complaining of any bowel disturbance whatsoever, whether of diarrhea or constipation, gives a good sequential history of the condition. And the second factor is a thorough abdominal examination.

Third, of course, is a digital examination of the rectum. This should be done routinely in all cases regardless of what the patient has and particularly in cases of suspected malignancy. Care must be taken to make this examination painless. As specialists we find that many peo-

ple have been driven away from other doctors perhaps two or three months before because the examination was so painful that they hated to go back. It is a simple but important matter to see that the finger is well lubricated up to the hilt.

If you find fissures or painful hemorrhoids and you want to do a sigmoidoscopic examination, see that the patient has some sort of anesthetic to make the examination painless. Be sure that you have a well-cleaned bowel. There is no need examining on the day the patient comes to see you. See that the bowel is well prepared on the night before, if he has no obstruction, and do the sigmoidoscopic examination under ideal conditions.

If this fails to give information, the next thing to do is to have an x-ray examination of the colon. Unfortunately in the past it has been either too easy or too cheap to say, "Go on and have an x-ray of the colon and see what is the matter." The trouble with that is that 75 per cent of all malignancies of the colon are in the rectum or lower sigmoid, what we call the rectosigmoid. The x-ray man knows very well that this is a blind spot and that you can have a carcinoma of the rectum as big as an egg and still have a perfectly good-looking x-ray picture. Therefore an x-ray examination is the last thing to order.

In these days many people on the outside are trying to make rules and regulations for us. It might come to that if we do not do a better job than we have done heretofore in early diagnosis. Following a few rules among ourselves may be a good step forward. Suppose an x-ray man had to have a written statement that a digital and proctoscopic examination had been made before he was allowed to do an x-ray of the colon. If we had a simple working agreement like that, much of our trouble today would disappear automatically and many x-rays of the colon would be automatically eliminated. I am sure, however, that the x-ray man would not worry about that because at least there would be one mistake that he might not have made.

Don't use the x-ray man as a laboratory man. Use him as a consultant. After your preliminary examination and history, you can give him some idea, perhaps, of what you are looking for. If he knows what you are looking for, he can help in the examination to show up various things; furthermore, he will be interested in so doing.

If everything in the examination fails, don't discharge the patient completely; keep him under observation and repeat this performance six to eight weeks later if it is necessary.

MANY believe that there is something unusual about a proctoscopic examination. No one has a patent on proctoscopic examinations. Every general practitioner ought to be able to use a five-inch proctoscope properly, and if he does, he will make a large number of early diagnoses.

The collected statistics show the approximate incidence of malignancy in the colon: cecum, about 6 per cent; both flexures and the transverse colon, about 17 per cent; descending colon and sigmoid, 14 per cent; rectosigmoid, rectum, and anus, 65 per cent. They show a high incidence in the lower rectum which can be seen or felt so easily by proctoscopic or digital examination.

No one knows exactly how many malignancies of the colon arise from multiple adenomatosis, but there is sufficient evidence to show that many of them do. We believe that 100 per cent of these people with multiple polyposis will develop malignancy if they live a normal life span. Therefore, it is important to eradicate adenomas or polyps wherever we find them. We know this simple fact also: that 70 per cent of all adenomas and polyps in the entire colon are found in the rectum, making them amenable to very simple treatment.

I would like now to discuss an unusual case. The patient had hemorrhoids removed, and a diagnosis of squamous cell cancer was made. He remained free from disease, but was sent to us with a secondary nodule in the submucosa. I felt that when there was secondary involvement of the bowel from a squamous cell ma-

lignancy, it probably should be subjected to radiation rather than operation. We treated him with radium, and the disease completely cleared up at this point for a period of fifteen months, when he returned with a nodule identical to that higher up in the bowel. We then felt that we could not radiate this. We did an abdominoperineal operation about a year ago and the patient made a very satisfactory recovery. Thus we cannot believe that all the rules that have been written about squamous cell malignancy of the anus are quite true.

In a group of 137 cases of adenocarcinoma of the rectum, in which we did one-stage combined abdominoperineal resections, there was not a death in the entire series. Bleeding occurred in 87 per cent; diarrhea in 36 per cent —and this is the great group that is being neglected today, for people are more apt to investigate constipation than diarrhea. You see duration of symptoms all the way from three months to twenty months. The lesion is palpable in 87 per cent of the cases. This diagnosis is the simplest and easiest to make. The pathology of the group was as follows: adenocarcinoma, 127; medullary, 3; squamous cell, 2; villous tumor, 4; mucosal polyps were associated with these specimens in 22 per cent.

The bladder gives us trouble in practically all cases, but it is very easily controlled now with the sulfa drugs. The entire hospital stay for this group of 137 cases was eighteen days. Now the hospital time is down to fourteen days.

It was my privilege in 1940 to show you a group of cases involving patients around thirty years of age with malignancy of the rectum and another group of cases over seventy years old. There were 4 cases in the younger group, 3 of which will be discussed below. Ordinarily malignancy in young people is considered a very bad thing. My own feeling has always been that if you diagnose malignancy early in a young person you can do just as much for it as you can in an elderly person. Of course, as a rule, nobody suspects malignancy in young people.

The first patient of this group came to us in 1933. At that time has was thirty years of age. His symptoms were bleeding at stool and diarrhea for eight months. He went to see the family doctor, a great friend, who just couldn't believe that the man was sick; he had always known him as a big, healthy fellow. However, the symptoms continued, and finally he got the diagnosis. When he came to us his red count was 3,300,000 and his hemoglobin was 48 per cent.

I did an abdominoperineal resection. The pathological report was adenocarcinoma of the rectum 3 x 4 inches with invasion of the muscularis and perirectal fat. The glands were negative, however. The patient was discharged from the hospital fourteen days after the operation. He has now gained weight, going from 160 to 230 pounds; he works every day, and also two nights. This man works hard. He worked on a truck for the city; now he is a general maintenance man for a large town. His colostomy gives him no trouble; he doesn't think anything whatsoever about it.

We first saw the next patient in 1939 when she was thirty-two. She complained of pain in the rectum, bleeding from the rectum, and decrease in caliber of the stool. The notes do not show whether it was constipation or diarrhea which was the chief complaint at that time. She says she had constipation. Many of them do, I think, until the tumor ulcerates; then when the tumor ulcerates and becomes secondarily infected, the irritation will produce diarrhea.

We did an abdominoperineal resection almost against her will. She did not feel as though she wanted to go through with it, but finally she persuaded herself that she should. The pathological report was: adenocarcinoma 2 x 3 inches infiltrating all the coats, with extension to the perirectal fat; the glands were negative. She was discharged on the sixteenth postoperative day. She has been well since that time and her colostomy gives her little or no trouble.

The third case is also unusually interesting.

This patient was pregnant at the time she had her symptoms of neoplasm of the rectum, yet examination was not made. She had a bloody diarrhea in the last three months of pregnancy. We know that pregnancy is supposed to have a profound effect on malignancy; in other words, that it is hardly worth while bothering with it. Examination was not made until four months after that, which was seven months from the onset of the symptoms, and at that time she was twenty-six years of age. The complaint was bleeding and diarrhea in the last two months of pregnancy, which continued for three or four months after pregnancy, when examination showed a hard, irregular, indurated ulcer the size of a dollar just at the tip of the finger.

In 1937 I did an abdominoperineal resection. There was an adenocarcinoma 2 x 2½ inches, with extensive infiltration of the mesenteric fat. Glands, however, were negative. That was nine years ago and she has been well ever since. In 1940 I removed a branchial cleft cyst which was incidental.

Here we have a combination of youth and pregnancy, yet with radical operation she has been well and productive since that time. Her colostomy gives her no trouble at all. She wears a band-aid over it and that is sufficient. It shows how simply care can be taken of some of these colostomies.

I have discussed these cases particularly because there is a shift to the left in treatment of neoplasm of the sigmoid and rectum. I personally went through that a good many years ago and had to take care of a lot of these cases for my older chiefs. I noticed early recurrence locally, which drove me to do something more radical.

Now we again see a tendency to preserve the sphincter. It will take some years to find out whether that is right or wrong; I know it was wrong before. I think that people are probably stimulated now by the fact that the mortality will be lower in that group because of the use of sulfasuxidine. Personally I have had no experience with it because I have not used any of the sulfa drugs in the preparation of any colon or rectum cases that I have handled. The mortality is about equal to that of others.

At any rate, for the present, I think it is the surgeon's obligation to do the most extensive operation he possibly can. The tendency is to do a small operation for a small cancer and a large operation for a large cancer, which is entirely wrong. It seems to me paradoxical to preach early diagnosis and bring the patient in and then do as small an operation as possible to save the sphincter. We do not do it anywhere else; we always advocate large operations for cancer elsewhere, and yet when it comes to the sensitive matter of whether you are going to preserve the sphincter or not, there is a tendency to do a smaller operation.

*Courtesy: American Cancer Society*

DIAGNOSTIC CLINIC

# The Concomitant Diseases or Conditions Associated with Polyarthritis

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UNIVERSITY OF KANSAS SCHOOL OF MEDICINE, KANSAS CITY, MO.

CHRONIC arthritis is not a disease just of the joints, since careful clinical and pathological studies show that a very high percentage of chronic arthritis cases are associated with visceral diseases, which, if properly analyzed, may throw considerable light on the etiology and therapy of rheumatoid arthritis.

My interest in the subject of arthritis dates back many years. In fact, it began immediately after the publication of the epochal papers on the relation of focal infection to chronic arthritis by Billings and Rosenow in 1913. Since then I have been an ardent advocate of chronic infections as causal factors, not alone in chronic arthritis but in many systemic diseases as well. The adherents of the focal infection theory, as you may know, have endured a good deal in the way of sneers and snubs and criticism in the past twenty years. However, the tide has turned; we no longer have to apologize for using the term focal infection or chronic infection. The reason for this change is that within the past few years the results of careful autopsy studies have established that chronic infections are a very important factor in arthritis as well as in many other diseases.

For instance, we used to be taught, even until the last year or two, that rheumatoid arthritis was wholly different from and not in any way related to rheumatic fever. These postmortem studies show that this is not so; they reveal that in a high percentage of cases of chronic arthritis, changes are found in the heart which are wholly indistinguishable from the changes in the heart in cases of rheumatic fever. It really is astounding when we think that postmortem examinations by reliable pathologists show that 30 to 60 per cent of patients dying with rheumatoid arthritis have cardiac lesions, valvular lesions of the heart, that are identical in every way with the valvular lesions found in rheumatic fever.

These studies have come from Boston, New York, Philadelphia, and Rochester, Minnesota. Perhaps the most comprehensive paper on this subject is entitled "Visceral Lesions Associated with Rheumatoid Arthritis," an article by Philip S. Hench in the *Archives of Pathology* for April, 1943. This was a report based on the *postmortem findings on 30 cases dying with rheumatoid arthritis at the Mayo Clinic; of these 30 cases, 16 showed very definite and*

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NOTE: Presented before the meeting of the Interstate Postgraduate Medical Association of North America, Cleveland, Ohio, October 15 to 18, 1946.

*typical valvular heart lesions, the same as those found in rheumatic fever.* Such findings tend to support, if not actually prove, the contention held by a few clinicians for a number of years, based on clinical studies alone, that rheumatoid arthritis is closely related to rheumatic fever, but with different manifestations because of the difference in the age of the patient and the virulence of the infectious agent.

Equally important as the heart findings was the fact that 19 of the 30 cases at the Mayo Clinic, or almost two-thirds, showed glomerulitis or pyelonephritis, and in one case a kidney stone was present. Furthermore, about 25 per cent of these 30 cases showed peptic ulcer, either active ulcer or the scars of healed ulcer in the esophagus, stomach, or duodenum.

The striking thing is how these postmortems are finally confirming not only what a few of the leading clinicians in the country have thought for a number of years—that the only cause of glomerulonephritis is a chronic infection—but also what many leading gastroenterologists have contended—that a chronic infection is the chief cause of peptic ulcer.

Of course, any tyro in medicine knows or should know that these visceral lesions are not complications of rheumatoid arthritis but that they are concomitant diseases and are all due to the same underlying cause, a chronic infection. If this view is accepted—and the only reason it cannot be accepted would be that men would refuse to accept postmortem findings—is it not rational therapy to remove or to advise the removal of infections to prevent arthritis, and to use prophylactic methods and thereby prevent other very serious visceral diseases as well, diseases of the heart, diseases of the kidney, diseases that kill, and kill early in life? If this is so, is it not advisable for doctors, instead of quibbling over whether they will give gold or sodium salicylate, or will sting a patient with bees, or do something else for joint changes of chronic arthritis—in which case they are just treating one phase of this whole chronic infection problem—to advise as prophylactic procedures, the removal of infections early in life?

PETER T. BOHAN

IN THE cases which will be reviewed, an attempt will be made to see if there is anything in the history or findings of these patients indicating a chronic infection or recurrent attacks of acute infections. Two of these 4 patients have definite evidence of rheumatic heart disease, such as the pathologists have been finding in rheumatoid arthritis.

*Case I*—The patient is a girl, thirty-two years old, single, who was, until nine years ago, a stenographer. Eleven years ago she developed an arthritis of her hands. It then went from one wrist to the other, then to one knee, then to the other. But she continued working for a year, when her trouble became so bad that she had to quit her job. At that time she changed doctors. The second doctor removed her tonsils and in a

month her arthritis had nearly disappeared. She went back to work, and she continued at it for about a year, when, all at once, she had a flare-up of arthritis in her knees and wrists and nearly all the small joints as well as her shoulders. For nine years she has done no work, and has been bedridden most of the time and in pain all the time.

THE general appearance of this girl is that of an advanced case of arthritis deformans, which is merely another name for a case of rheumatoid arthritis which has had bad management. In fact, this girl has not seen her doctors very often because she said they did not give her much hope and did not seem to be interested in her case. Her doctors had probably been reading the literature and had accepted such statements as "the cause of arthritis is not known," "it is a progressive disease," and "there is nothing to do for it." I do not accept any of these statements.

The main feature of this girl's case is the contractures of her joints. Most deformities and limitation of mobility of joints are caused not by bony ankylosis, but by fibrous contracture of periarticular soft tissues and muscles. Most of these joint deformities are due to flexure contractures because of pain. The only satisfactory therapy is prevention. No patient, of course, should be permitted to use pillows under the knees.

In at least 90 per cent of these cases the pain can be controlled by adequate doses of salicylates, either aspirin or sodium salicylate, thus preventing muscle spasm. Also, there is abundant evidence that salicylates desensitize the joint structures, thereby preventing the exudate that is rich in fibrin, which is the "glue" from which fibrous tissue is formed. There is no bony ankylosis of any of these joints.

This patient has been in the hospital under Dr. Russell Haden's care for less than a week. He has used traction on her legs and she thinks her knees are better already. I examined this girl for a few minutes yesterday; she has the typical findings of a mitral stenosis of about grade II. This is a clue to her having, or having had, an infection in her upper respiratory tract. She was relieved for one year following a tonsillectomy ten years ago. When the arthritis recurred a year later, did she also have an endocarditis?

Another fact of importance is her history of prolonged colds in her head three or four times every winter. This is suspicious evidence not only of recurrent sinusitis but also of improper living habits, such as hot baths and a home that is too hot or too cold. Her appearance indicates inadequate or poorly balanced diet.

Now, in spite of her deformities and disability of nine years' duration, if she will cooperate with Dr. Haden, in six to nine months she should be free from pain, her joints will be straight, and she will be restored to economic independence.

*Case II*—This patient's trouble began eight years ago, and the doctor gave her some medicine, probably salicylates. At the end of a few months her symptoms had subsided and did not bother her much until two or three years ago. Then it came back in her wrists and fingers.

She presented herself at the Cleveland Clinic two years ago. At that time she complained of pain, stiffness, and swelling of her hands. She also felt exhausted and depressed. Examination showed then, as now, fusiform swelling of the middle joints of the fingers and Heberden's nodes of the terminal joints. Laboratory studies showed a rapid sedimentation rate—it was about three times normal.

DR. BOHAN: You have been coming here for two years, haven't you?

PATIENT: That is right.

DR. BOHAN: You have had more or less trouble with your sinus for some time?

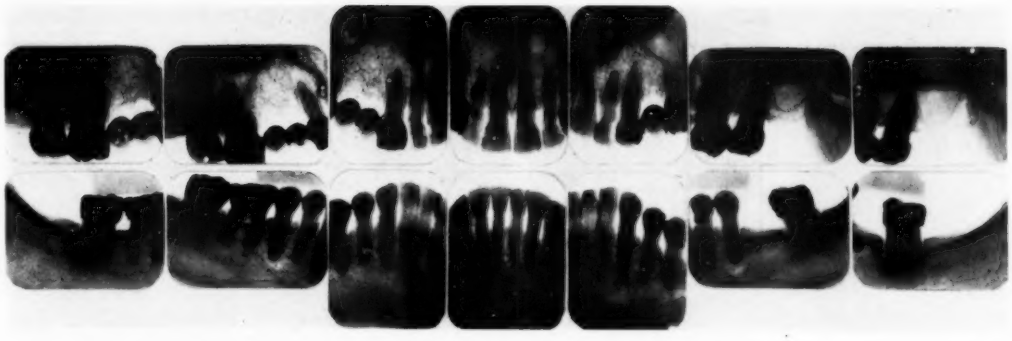
PATIENT: Yes. That dates back about six years.

DR. BOHAN: When did your arthritis come on?

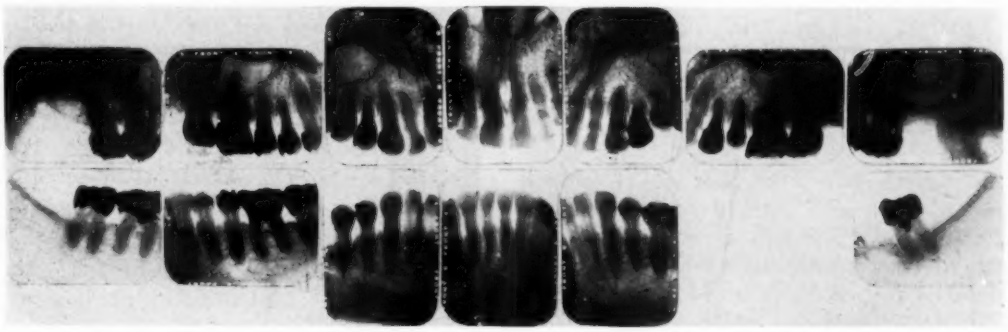
PATIENT: I was troubled with that about eight years ago.

DR. BOHAN: Your antrum was opened and drained about a year ago, wasn't it?

PATIENT: That is right.



Case II-A. These films taken May 25, 1945, show high grade oral sepsis. Following extraction of four teeth with root fillings in the upper jaw and "checking all others," there was no improvement of the arthritis.



Case II-B. This set of films was made October 9, 1946. The findings justify advising extraction of all teeth in the upper jaw and all molars in the lower jaw. Indications are the same as in May, 1945.

DR. BOHAN: Did that influence your arthritis in any way?

PATIENT: I didn't notice that it did.

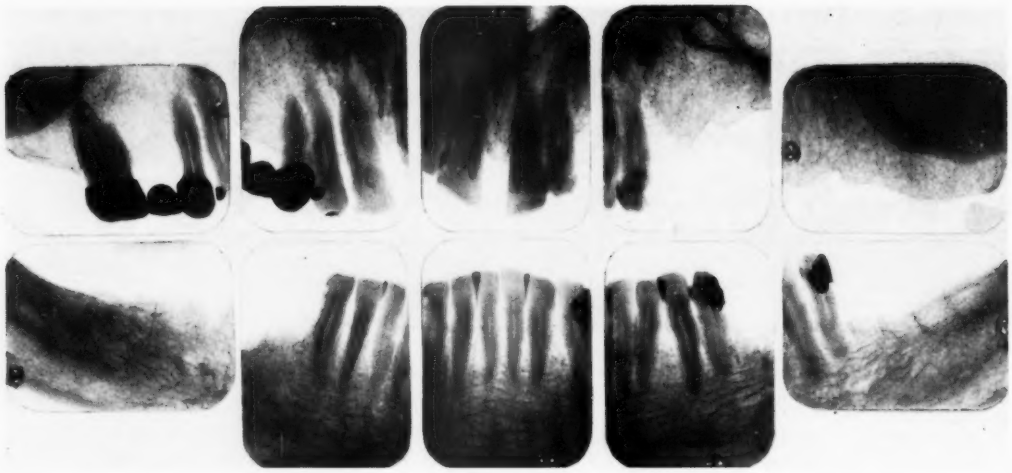
She has an enlargement of the middle joints of the fingers, and what I would like to emphasize particularly is that she has a marked enlargement of the terminal joints of both little fingers and some enlargement of the terminal joints of the other fingers—typical Heberden's nodes.

DR. BOHAN: Do you think the trouble with these terminal joints is due to the same cause as the pain and swelling in the middle joints?

PATIENT: Yes, I think so. It all came on about the same time.

This is the answer we obtain in two cases out of five from patients with such involvement of the finger joints. Of course the changes in the terminal joints are typical of a degenerative arthritis and the spindle-shaped swelling of the middle joints is typical of rheumatoid arthritis. But does it seem logical to assume that the disease of these joints, only an inch apart, is wholly unrelated etiologically?

In my experience, I have never seen a case with bad Heberden's nodes that did not have oral sepsis—not dead teeth, but gingivitis or pyorrhea. It is always easier to tell a middle-aged woman that her Heberden's nodes are due to infections, not senility, and this is my belief.



Case III. From these films it would be difficult or impossible to diagnose oral sepsis, or at least enough to account for all the arthritis this patient has had, and particularly for his cardiac condition. However, as pointed out in the text, the evidence of badly infected tonsils for a number of years is obvious and apparently the sole cause of his arthritis and heart disease as well.

This patient has a number of filled and crowned teeth and marked recession of the gums. I have never seen a patient with false teeth and Heberden's nodes who did not have the nodes first. A year ago Dr. Harris at the Clinic opened and drained an infected antrum without results. Is it not possible that the oral sepsis was a causal factor of the sinusitis? For a number of months this patient has been getting gold shots but her arthritis remains uninfluenced.

*Case III*—This patient is a traveling man, fifty-five years old. His trouble came on him rather suddenly seven years ago with pain in the knees, hips, back, shoulders, and hands. He had very little swelling of any of the joints; he doesn't know whether or not he had fever. At that time he went to a hospital here in Cleveland and stayed there for two months.

DR. BOHAN: You couldn't walk when you went there?

PATIENT: They carried me in.

DR. BOHAN: How were you when you left? Did they carry you out?

PATIENT: Yes.

DR. BOHAN: Then you went to Florida?

PATIENT: I went to Florida on my back.

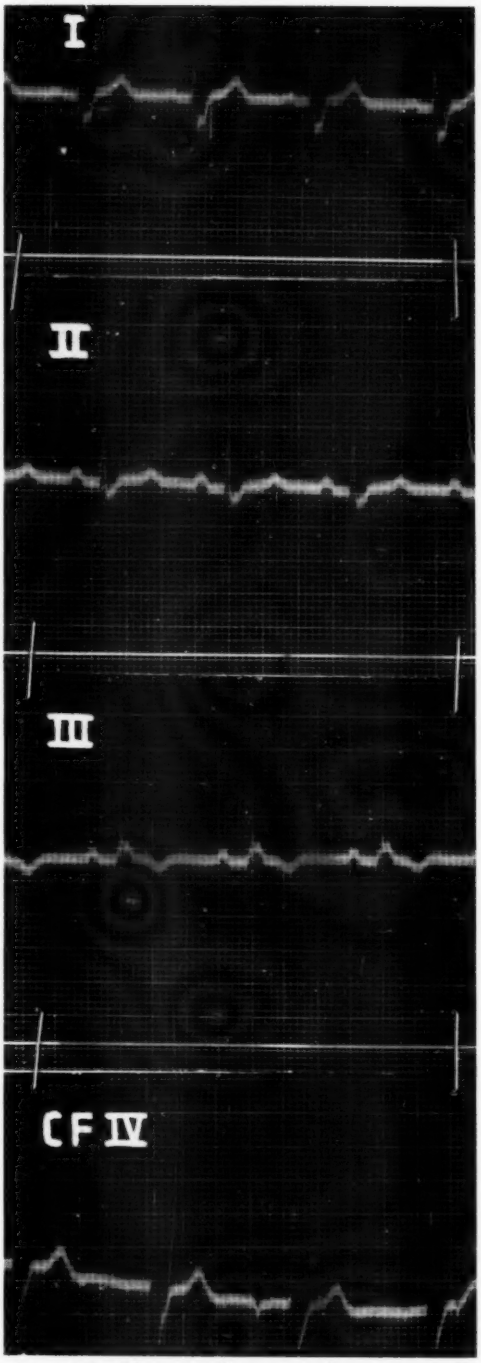
DR. BOHAN: But while you were in Florida you got up and about, didn't you?

PATIENT: In about five months.

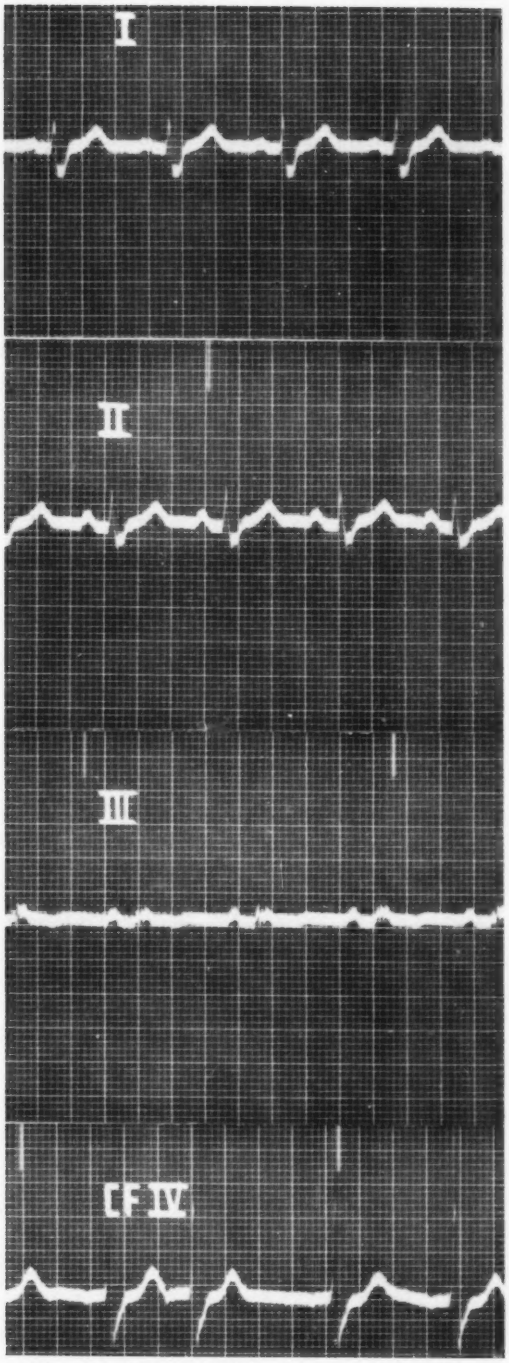
DR. BOHAN: He has been going that way ever since.

There is nothing to find about his joints now. He has no pain or limitation of motion of any of his joints. He explains his gait by saying his ankles are stiff, but examination of his ankles is negative. When asked why he doesn't work he says he is too weak and is afraid he will get a dilated heart.

The more one analyzes this man's complaints the more they sound like functional trouble rather than arthritis. All of his complaints are dominated by fear. Furthermore, he has been getting compensation for total disability for seven years.




Case III. Electrocardiogram taken August 21, 1942, showing right bundle branch block.




Electrocardiogram taken June 4, 1946, showing heart condition unchanged.

WITHOUT a complete physical examination, the diagnosis would have to be psychological rheumatism. Yet examination of his heart shows an apical presystolic murmur and a persistent coupled rhythm. The electrocardiogram illustrated shows bundle branch block, which was found in 1942. Since he has never had rheumatic fever, the diagnosis has to be rheumatic heart disease as a concomitant disease of rheumatoid arthritis. The cause? He insists emphatically he never had tonsillitis or sore throat in his life, but he has marked asymmetry of the tonsils, the right being much bigger than the left. They are both cryptic and he has a palpable gland at the angle of the jaw on each side. This should be enough to establish the diagnosis of infected tonsils. His record at the Clinic shows that Dr. Harris made the diagnosis of chronic tonsillitis in 1945 and again in August, 1946. Thus, if this patient had had a tonsillectomy in his youth he probably would not be totally disabled today.

*Case IV*—The patient came to the Cleveland Clinic in July, 1935. At that time she complained of recurrent pains in her feet and chest. The symptoms had been severe for six years; in other words, her trouble began seventeen years ago.

After examination and review of the laboratory studies, it was concluded that this was a case of Marie-Strümpell spondylitis. What does Marie-Strümpell spondylitis mean? It is nothing more than rheumatoid arthritis of the spine.

The x-ray pictures are very typical of an ankylosing spondylitis, which, of course, the Sister has. She has a complete obliteration of her sacro-iliac joints accounting for the pain in her legs and the lower part of her back when the trouble began. She has a little trouble in the vertebrae of her neck, as most of these patients have.

What is the cause of the Sister's trouble? The x-ray pictures, according to the interpretation of the roentgenologist at the Cleveland Clinic, show that she has sinusitis.

DR. BOHAN: Don't you have colds occasionally, Sister?

SISTER: I have since March, but not before that.

DR. BOHAN: Anyhow, here is the chronology the Sister herself wrote down: Abscess in her ear when she was two days old; measles when she was three years old; whooping cough at seven; sore throat at ten; influenza when ten with severe nosebleeds. She had a little sinusitis then, didn't she? She had St. Vitus' dance in her twelfth year, sore throat at twelve and again at thirteen, with a high temperature; appendectomy at seventeen with a stitch abscess; phlebitis at eighteen. She had pains in the chest and between the shoulders with temperature when she was twenty-five—bed rest for six weeks. When twenty-six she had severe pains in the hip and leg. Walking was difficult, and this continued for several months. She had a kidney infection at twenty-seven; tonsillectomy at twenty-eight—a little late.

She certainly has a history of infections—enough to account for her spondylitis, as well as the kidney infection and chorea.

DR. BOHAN: Are you any better than you have been, Sister?

SISTER: I am some improved.

DR. BOHAN: But you are in pain most of the time?

SISTER: Yes, Doctor.

DR. BOHAN: But she works every day. You teach every day, don't you, Sister?

SISTER: Yes, I do, Doctor.

DR. BOHAN: In conclusion I would like to tell you of a patient I saw in an Army camp three years ago. I was invited to come down there and discuss the subject of arthritis. When I finished, a young colonel thirty-eight years old, head of the surgical service, came to me and asked if I cared to hear his personal experience with spondylitis. I naturally told him I did. I will give you his story briefly.

He began by saying, "Five years ago tonight I was on the flat of my back in bed with a plas-

Case IV. Film of cervical spine shows calcification of the spinal ligament between the last cervical and the first dorsal vertebra.

This film shows destruction and ankylosis of sacroiliac joints. Generalized atrophy and calcification of spinal ligaments with bulging at intervertabral areas in lower dorsal and upper lumbar regions. Bamboo spine.

ter of Paris cast from the middle of my thighs to my neck." He continued by saying that after tolerating this torture for five weeks, sleeping two hours out of twenty-four, he told his doctors that unless they took the cast off he would kill himself. The doctors realizing that he meant what he said, took off the cast. He then proceeded to treat himself and at the end of one year returned to work and has worked night and day since.

I then naturally asked him what his treatment was. He said, "Aspirin and not another thing—90 grains every day for 365 days and 90 grains twice every week since." He returned to work four years ago.

After complimenting him on his intelligent management, I then asked if he thought he got sick in the first place because he had not taken aspirin all his life. He said, "I know exactly what you mean. I am having them out one or two a month, and in a short time I expect to have complete dentures just as nice as yours."

DIAGNOSTIC CLINIC

# The Differential Diagnosis of Low Back Pain

MAXWELL HARBIN*

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Low back pain is a very frequently encountered problem and one which I know you all see at one time or another. We orthopedic surgeons see these patients all too often ourselves, perhaps because almost 50 per cent of our patients today seem to be those with low backache, and many of them with pain down the leg, either in the front or back or on the side.

In the problem of low back pain, one of the most important things is a complete history. A complete physical examination should be done on all these patients. I would emphasize that the patient should always be completely disrobed. We shall assume that the examination has eliminated the genito-urinary organs as a factor in the production of symptoms. The mode of onset of low back pain is of considerable importance. This should be determined accurately from the patient.

The presence of an injury, sufficiently severe to produce some pathologic change capable of causing pain in the back, must be obvious. In cases in which the question of compensation arises, the accuracy of the description of the injury may be questioned. These cases are always difficult to handle, and it is often necessary for the physician to judge the honesty of the patient.

Insidious onset may apply to a multitude of conditions. In fact, most conditions which produce backache, with the exception of those which are included under the heading of trauma or traumatic spondylitis, may have an insidious onset.

The type of pain is a most important point to determine. In many cases in which the pain is constant it may be difficult to decide what importance to attach to the patient's description of the pain. However, many patients give a definite history of pain which is brought on by activity and which is relieved by rest. This type of pain has been called static. Many cases belong to this group. In general, a pain in the back is more likely to be the result of traumatic or hypertrophic arthritis, but occasionally it may be caused by postural strain. In cases which give a more or less opposite history, the condition may be considered infectious in origin. In this group the patient gives a definite history of pain which is noted particularly

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NOTE: Presented before the meeting of the Interstate Postgraduate Medical Association of North America, Cleveland, Ohio, October 15 to 18, 1946.

after resting and upon arising in the morning. Such pain wears off after activity. These two groups of symptoms may be combined in some cases. It cannot be said that any hard and fast rule or conclusions can be drawn from these facts, but they are, however, helpful in sizing up a case.

MAXWELL HARBIN

WE SHALL proceed with two cases. We shall not have enough time to consider the more unusual types of low back pain caused by tumors of the lumbar spine and pelvis, nor metastatic tumors in the same region, nor the rarer types of infection such as osteomyelitis, actinomycosis, typhoid, brucellosis, or gonorrhea.

We must, therefore, limit ourselves, unfortunately rather briefly, to the common postural type of backache, the congenital anomalies such as spondylolisthesis, unstable back, trauma, acute and chronic fractures, and the sprains, the so-called strained back, posttraumatic neuroses, and radiculitis, which, you know, is so popular today, referred to as rupture of the nucleus pulposus. We may also briefly mention the ependymal adhesions of the cauda equina and peridural varicosities. Time does not permit a discussion of the diseases of the spine such as arthritis and tuberculosis, but I hope to make a few remarks about fibrositis.

The history is of tremendous importance in the differential diagnosis of low back pain. The first patient is a female, forty years old, who was well until six months ago when she developed, without known cause, a dull pain in the low back, radiating down the posterior left thigh, with pain quite acute for two weeks; it was considerably relieved by rest in bed. The pain was not associated with any known trauma.

Six weeks ago the pain extended into the lower leg and into the sole of the left foot. She also noted some numbness of the sole of the foot; sneezing and coughing aggravated the pain. She has been in the hospital several days. She tells me that rest in bed has not relieved her symptoms.

The patient, when possible, should be examined with the clothing removed, and the contour and position of the back noted. Motion is of great importance, as well as posture. This patient stands with a moderate lordosis, and with the left knee slightly flexed, and that is of significance.

We are interested in forward motion as to whether there is limitation, and to what degree. When the patient bends forward, mobility is relatively good, and there is motion in the lumbar spine up to seventy per cent of normal. Flexing to the left is painful and is of significance in this particular situation. Hyperextension of the back is also painful. As you will recall, there has been no history of injury.

I wanted to demonstrate to you the ordinary tests that we do for these back cases. Points of tenderness are important, particularly the constancy of these points of tenderness: (1) whether there is tenderness in the lumbosacral region; (2) whether it is central between the

fifth lumbar and the sacrum, or whether it is to one side or the other.

### FURTHER SYMPTOMS

THE patient has no tenderness in the lumbosacral region. She has tenderness over the fascia overlying the sacro-iliac. I am not palpating the sacro-iliac synchondrosis; it cannot be done. One merely palpates the fascia over the posterior ilium; the joint is two or three inches below. She has tenderness over the entire left sacro-iliac fascia, not the joint.

Another point of importance is the matter of tenderness over the posterior superior spine of the ilium. She has no tenderness whatever except over the fascia overlying the left sacro-iliac. Sacro-sciatic notch tenderness is very important, particularly in radiculitis. She has no sacro-sciatic notch tenderness on either side. Turning over on the back is painful.

All that we have so far in the way of positive signs is some pain on hyperextension of the back, tenderness over the left sacro-iliac fascia, and pain on flexing toward the left side of the body. A so-called Lasèque's sign or straight-leg raising test should be done. This consists of extending the leg with the knee completely extended; when pain along the back of the thigh occurs, it is known as a positive test. It occurs in various types of radiculitis.

Flexion of the left hip is painful at 35 degrees. There is no pain on right straight-leg raising. The reflexes we will not take the time to go over. Her knee jerks and ankle jerks are normal. She has no gross sensory change. Her roentgenograms are negative.

How are we to identify this condition? There is no history of injury. She merely has tenderness over the left sacro-iliac fascia, but she does have a characteristic type of radiation of pain down the posterior thigh along one of the elements of the sciatic nerve, and the pain on straight-leg raising is suggestive of radiculitis in association with tenderness. Frequently, however, tenderness is present in radiculitis over the lumbar spine, the fifth, commonly, sometimes the fourth, usually toward one side or the other. I think we have to conclude that this patient has a mild radiculitis, and the most common cause of that, as you know, is herniation of the nucleus pulposus, which in her situation, with radiation of pain to the sole of the foot, would suggest the fifth somatic level, that is between the fifth lumbar and sacrum.

However, that cannot be absolutely determined, since her signs are not entirely typical, but must be left to treatment. If the pain becomes more severe, if she has more disability, and if the usual conservative measures fail to give her relief, then it will be necessary to carry out opaque intraspinal studies for determination of the site and degree of the lesion.

The second patient, male, thirty-four years old, has a most extraordinary story. He had no difficulty until four days ago. Eight hours before he came into the hospital he was pulling up some tree roots, bending over naturally, when he felt something suddenly give in his back. The pain and resulting numbness in both legs was so severe that he could not walk from the place he was standing—a sudden onset. The pain radiated down both legs posteriorly, and the numbness, which was rather diffuse, lasted for a short time. He was unable to straighten up. On his admission to the hospital he had a slight list to the right, with muscle spasm and general tenderness over the fourth and fifth lumbar spines and both sacro-iliacs.

We shall discuss a few points in regard to a patient with acute onset of low back pain and leg pain in contrast to the patient just described with the gradual onset of not so severe a degree.

The second patient moves with much more caution, and that is of great importance. In contrast to the other patient, he has a straight lumbar back. That is very significant and is commonly associated with irritative lesions of the low lumbar spine. One should also inspect the back for a list toward the right or left. Not always, but frequently patients list away from the side of pain.

His lumbar back remains straight when he bends over and keeps his knees straight. He says it is painful. It hurts in the lumbosacral region. The back is quite limited in bending to left and right. When he bends backwards, he has good hyperextension.

With the patient lying face down on the table, palpation shows that he has tenderness in the lumbosacral region. When he came into the hospital he had complete loss of both knee jerks and ankle jerks. In forty-eight hours he had recovered these reflexes. His pain had lessened. There is now no pain or tenderness over the posterior superior spines of the ilia. The patient should always be relaxed when palpating for points of tenderness. There is no tenderness over the sacro-iliac fascia and no sacro-sciatic notch tenderness.

There is pain at 35 to 40 degrees on left straight-leg raising. During the first day in the hospital he would only allow 20 degrees, and the same on the right side, rather symmetrical. Both knee jerks and ankle jerks have returned. This patient demonstrates a condition with acute onset, with obvious sudden irritation of certain elements of the cauda equina. His roentgenograms are entirely normal.

One must assume that for such a condition to have cleared so rapidly he must have had a large disruption or protrusion of the posterior portion, probably of the annulus fibrosus or the intervertebral disk. Bed rest and traction, which he had, must have resulted in the disk's slipping back. It does happen. These disks change position frequently. That is the reason these patients have a history of recurrence of pain, a period of freedom, and a period of recurrence which may be acute or mild.

I would cite one point in the differential diagnosis of low back pain, namely, the use of novocain. In patients in whom one suspects the possibility of a focal fibrositis in contrast to irritation of elements of the caudal roots or the sciatic nerve, it is wise to infiltrate those so-called trigger points with novocain to eliminate that as a factor of pain. In fibrositis of the low back (and it is not uncommon, but at times rather difficult to differentiate from a radiculitis) this novocain test serves two purposes: it aids in the differential diagnosis of the cause of low back pain, and also, in perhaps 50 per cent of patients with fibrositis, gives relief. Remember that with fibrositis of the low back, particularly the focal type, there may be radiation of pain down the posterior thigh, but it rarely goes below the mid-thigh. When pain goes below the mid-thigh or below the knee, fibrositis is not the causative factor; there is something of a deeper character resulting in nerve irritation.

The pain which flows from the low back fibrositis is the result of muscle spasm. It may be beautifully demonstrated in the so-called fibrositis of the elbow or so-called tennis elbow where just below the lateral epicondyle the point of tenderness is situated and the pain flows down the forearm. The same thing happens in the low back.

When this process is focal, it can largely be determined by the use of novocain at the trigger point. This patient had novocain injected in the tender point, namely, the lumbosacral fascia or ligament. He received much and rather quick relief from pain, but at the same time had the reflex changes, the sudden onset, the symptoms of numbness and pain down the leg, all of which were very definitely pathognomonic of an irritation of certain roots, certain of the caudal trunks in the low lumbar spine.

This subject is a very broad one and is very important from the standpoint of many types of patients, both from an industrial standpoint as well as the ordinary private patient's relief of his disability. I would, above all else, like to re-emphasize these points in differentiation of these low back conditions, namely the need for a thorough chronological history; inquiry as to the element of force applied initially; location of the constant points of tenderness; a thorough physical examination; also, in a certain number of cases where there is radiation of pain down the leg, a complete neurological examination, and always roentgenograms of the lumbo-sacral spine to exclude such diseases which are visible in the roentgenograms.

# EDITORIALS

## REPLACEMENT OF THE COMMON DUCT

THE REPAIR of an accidentally incised, ligated, or clamped ductus choledochus within a few days of its occurrence usually is a simple matter for the seasoned surgeon. The replacement of the common duct (intra-abdominal biliary fistula) will try the soul of the most skilled. Much misleading and footless surgical argumentation would be forestalled if the facts and conceptions concerning the repair of a common duct—and also the construction of a synthetic common duct—were carefully kept in their respective technical pigeonholes. Much of the literature on common duct reconstruction the past thirty years has produced more heat than light as is customary with surgical problems during the groping for solution. The problem has not as yet been adequately solved.

An outstanding contribution to the tools and artifices of common duct replacement was revealed in the March, 1947, issue of *Surgery, Gynecology and Obstetrics,* by Dr. J. G. Montgomery of Kansas City, Missouri, who relates his successful experiences with the "Use of Umbrella Catheter To Produce Internal Biliary Fistula."

The bulbous end of the catheter prevents the too early passage of the tube, thereby insuring its retention for the all important time interval during which a reasonably dependable fistulous tract becomes fabricated. The crux of all rubber or metal tube operations of this type is the transcendent time interval. How long should the tube remain? How long is long enough?

In healthy experimental animals, with normal tissues—with prompt recoveries from aseptic procedures—with early feedings and adequate fluids, and concomitant normal biliary outputs—the rubber tube needs remain in situ but five days. Per contra, for the debilitated individual with deep jaundice—with electrolytic imbalance—with protein deficiency—with an anxiety overlay—and with the available reconstruction tissues impregnated with antagonistic biliary salts—the required time interval for the successful production of an internal biliary fistula, is a matter of many weeks of skilled postoperative management.

Despite the recorded successful cases in which the tube passed prematurely, much attention has been given to methods by which this may be prevented. Dr. Charles H. Mayo devised and successfully employed rubber tubes which were manufactured with an irregular external surface, so that the encircling tissues would grasp the outer walls and prevent the too early extrusion of the tube into the bowel. A cuff of rubber, turned down on the end of a pure rubber tube serves dependably, although the cuff slightly narrows the underlying lumen of the tube. The umbrella catheter, as suggested by Dr. J. G. Montgomery, has the advantages of: (a) being procurable in pure rubber; (b) being available in acceptable calibers; (c) immediate accessibility in most hospitals; and (d) having a bulbous perforated end.

The writer plans to utilize on the next duct replacement case, a pure latex umbrella or mushroom type of catheter such as successfully employed by Dr. J. G. Montgomery—although probably he shall be tempted to amputate most

of the "mushroom" and depend on the resultant funnel-shaped tip to retain the catheter in situ for an adequate interval. It does not require much resistance for the retention of this fistula-producing tube, if the distal end is not permitted to project more than three to four inches into the duodenum.

The writer concurs in Dr. Montgomery's opinion that the present available Vitallium tubes have many disadvantages, not outweighed by their acceptability by the contact tissues, nor their larger bore versus outside diameter, compared to pure rubber tubes. The great number of patients who have worn latex T tubes in their common ducts for months or years, negates most of the arguments for Vitallium tubes so far as concerns the alleged irritability of pure rubber tubes used in duct replacement procedures.

It is doubtful that a T tube should ever be employed in the replacement of a common duct. It is one thing to remove a T tube from a sturdy original common duct which has required drainage for a protracted interval. It is quite another thing to drag from a tenuous fistulous tract, the tearing angular wedge of rubber, as many surgeons have regretfully discovered.

Failures in this work have been encountered as a result of infection of the fistulous tract occasioned by the use of a T tube. It is well recognized that most fistulous tracts following cholecystectomy, for instance, become infected if the drainage tube is not removed within five days. A common duct with a T tube inserted for prolonged drainage can "take it" so far as concerns infection which follows down the limb of the tube projecting through the skin surface. This is not the case with the less resistant tissues upon which one must rely in the production of a fistulous tract, and it is a recognized cause of failure. Some failures are occasioned by the inadequate output of bile following the decompression of the liver in those cases which have complete biliary obstruction. Some patients have been operated on after the liver has "died" so far as concerns resumption of function. Biliary pressure is the most important factor in the maintenance of so-called permanent biliary fistulae. Abundant bile output is of the greatest importance during the many weeks required for the establishment of a synthetic common duct.

Fortunate is the unlucky individual whose common duct mishap results in an external biliary fistula rather than a healed duct stump and an intense jaundice. The surgical preparation of such a patient is quite simple. That required by the chaotic physiological chemistry in the patient who for many months has had no discharge of bile, demands meticulous attention to the protein, sugar and electrolyte balances.

PATIENTS who require common duct replacements are *not* emergency cases. Special preparatory medical treatment is needed. They should not be operated upon by the average surgeon. Many die who fall into hands which may brilliantly perform a thyroidectomy or a hysterectomy. While the operation itself is quite simple, there frequently is a great amount of exacting dissection required to separate the agglutinated tissues in the average case; because of the race against time this is an agonizing procedure on a patient who is precariously near the edge. An unusual anatomical erudition is requisite for the baffling problem of locating and identifying the proximal stump of the common duct in the shortest time. This is true even in those simpler cases in which a so-called persistent external biliary fistula is present. These non-jaundiced patients can better withstand the inescapably lengthy exploratory procedure, because they can be more assuredly fortified for severe surgery, than can the individual who has had complete biliary blockade of long duration.

Should one question the complex and exacting problem of modern, laboratory-checked, adequate preparation of an acholic patient for surgical exploration, a review of the excellent article entitled, "Management of Jaundice Patients," by Dr. Albert M. Snell of Rochester,

Minnesota, in the April 19, 1947, issue of the *Journal of the American Medical Association,* should convince the doubter as to one's moral responsibility in the surgical preparation of the victim of choledochus blockade. Not all cases of common duct occlusion following surgery are due to surgical accidents. A phlegmonous process which can cause gangrene of the gall bladder can also extend via thrombophlebitis and destroy the common duct. Slow asymptomatic cicatricial contraction of tissues following surgery on or near the common duct can produce occlusion, which usually becomes evident within sixty days.

Replacement of the common bile duct is no field for the tyro, nor for the opportunist. Patients with long-standing jaundice following surgical procedures in the vicinity of the common duct should be referred to men whose clinical souls have been scarred with defensible surgical disappointments, and who have thereby learned the most dependable solutions for this disastrous pathology. Even in their seasoned hands, the percentages of failures and deaths will be high—but those who died shall not have died in vain.

A.G.S.

## RELATION OF BLOOD GROUPS TO DISEASE

MANY efforts have been made to correlate the human blood groups with various syndromes of uncertain etiology. The discovery of the workings of the Rh factor has given hope to these undertakings, because the Rh factor produces erythroblastosis fetalis only by crossing the placental barrier. If one antigenic system can give rise to pathology, there is little objection to the belief that others might do so. However, attempts to find other similar conditions have not been particularly successful.

Bakwin and Wiener have reported a study in the *Journal of Pediatrics* for January, 1947, on 23 patients with congenital athetosis, who had had icterus gravis during the neonatal period. Icterus gravis may result from Rh or A-B sensitization, as well as from other causes. Hence, the investigators sought to determine whether the athetosis might not also have been caused by the blood group incompatibility. Upon testing the bloods of parents and children, the investigators decided that the Rh and A-B factors could not have been the cause of the congenital athetosis in the majority of patients.

In another investigation, Jungeblut and his associates attempted to correlate blood groups with the occurrence of poliomyelitis. Their findings, published in *Annals of Internal Medicine* in January, 1947, suggest that persons of blood groups O, $A_2$, and "non-secretor" types suffer paralytic involvement in poliomyelitis more often than might be anticipated from the proportions of these types in the population. Likewise, "secretors" and persons of group B are less frequently affected than might be expected. Paralytic patients show a frequency of blood group $A_1$ that is essentially the same as that of the normal population.

C.R.

## TOOTH DECAY AND VITAMIN DEFICIENCY

FOR several years now, physicians and dentisis alike have discussed and disputed the possible relationship between tooth decay and vitamin deficiency. Many investigators have maintained that tooth decay is caused, at least in part, by an insufficiency of vitamins in the diet. Other students of the subject have taken an exactly opposite view—have held, in fact, that persons with properly balanced diets are more susceptible to tooth decay. A recent study conducted at the Hillman Hospital, Birmingham, Alabama, by Mann, Dreizen, Spies, and Hunt, should throw light on the question.

These investigators who reported their work in the February 15, 1947, issue of the *Journal of the American Dental Association,* demonstrated that malnourished persons have less tooth decay than well-nourished persons. They had as their subjects 233 patients. Several different tests for dental caries and vitamin de-

ficiency were performed on each patient. Furthermore, the patients were carefully examined clinically for any evidences of malnutrition. Of the group, 124 showed evidence of nutritional deficiency diseases. There were actual lesions caused by malnutrition, or chemical examinations revealed low blood vitamin levels. The remaining 99 patients presented neither lesions nor low blood vitamin levels; they appeared to be well-nourished.

The 124 poorly nourished patients had an average of 2.07 tooth surfaces decayed, 1.60 teeth missing, and 0.96 tooth surfaces filled. The 99 well-nourished patients had a much poorer record. They averaged 3.21 tooth surfaces decayed, 2.23 teeth missing, and 9.75 tooth surfaces restored.

Obviously, therefore, the poorly nourished group had much less dental decay than those on adequate diets. Actually, the malnourished persons had on the average only about one-third as much evidence of tooth decay as did the well-nourished individuals. However, the poorly-fed persons had much more pyorrhea than did the well-nourished.

R.W.C.

## HOW TO USE LANTERN SLIDES

Words are the means we have for conveying to other persons a picture that is in our own mind. If we can show them the picture directly, so much the better; we save a great many words, and words and picture act to drive each other home. There is a double chance that our material will be remembered, for it is reaching the brain in two ways, by eye and ear. From the audience's point of view, this double channel eases the strain of concentration, insuring a correct interpretation of the picture in the lecturer's mind.

Lantern slides are thus a great adjunct to a lecture whenever their material is directly pertinent, and it is worth while taking pains to realize this advantage to the fullest. So many otherwise excellent talks are reduced to 25 per cent effectiveness by poor handling of slides that it may be helpful to list a few common-sense do's and don'ts in their use.

If you want to hold the attention of your audience:

1. Coordinate your slides carefully with the text and arrange them in proper sequence. If not of a sort to be coordinated they should be shown all together, usually after the lecture, not during it.

2. Leave each slide on the screen long enough for the audience to comprehend it; discuss it appropriately, and then remove it.

3. Slides should be easily legible even from the rear of the room.

4. Some slides present evidence, some conclusions. There is a proper place for each.

5. Know your slides well enough to discuss them without turning your back on the audience.

6. Use a pointer to gain clarity and emphasis.

What not to do:

1. Don't leave a slide hanging on the screen while you talk about something else.

2. Don't try to get too much on one slide. It is a picture, graph, or chart, not a book.

3. Don't read the slide to your audience. They can read.

4. Don't talk to the slide; talk to the audience.

5. Don't scratch the screen with your pointer. If electric, don't flash it around the room, and don't let it play on the screen except when in use.

6. Don't call for the next slide before you have discussed the one on the screen.

7. Don't change slides too rapidly. Give each one a chance to sink in.

8. Don't use slides at all unless they are good ones. Better a good talk without slides than a potentially good talk interrupted by poor slides.

R.O.

# This Month in Medicine

## PELLAGRA

THE cause of pellagra has been a subject of scientific dispute for hundreds of years. And it is not yet settled. Although many modern writers assume it to be caused by a deficiency of nicotinic acid in the diet, others have marshalled substantial proof that pellagra is caused by a toxic principle in corn.

Recently, Raska has proposed that adenine, a constituent of many physiological catalysts, may be responsible for pellagra. This investigator believes that the proper regulation of the concentration of free and bound adenine in tissues and body fluids is of considerable importance to the animal economy. He disturbed that regulatory mechanism by feeding large quantities of adenine to dogs and rats. In this manner, he interfered with the normal metabolism of adenine-containing substances, vitamins, hormones, and enzymes. As a result, the animals developed pellagra-like lesions, characteristically observed in experimental avitaminosis.

Raska believes that the adenine combined with the vitamins, particularly those of the B-complex, and thereby prevented their utilization by the animal. If similar mechanisms occur in human beings, the elimination from the diet of foods containing adenine, in a form that leads to avitaminosis, may bring a reduction in pellagra. At any rate, Raska has undertaken an analysis of the adenine content of certain foods.

### SUGGESTED READING

EDITORIAL: Pellagra and corn. Nutrition Reviews, 3:267, September, 1945.

WOOLEY, D. W.: The occurrence of a "pellagragenic" agent in corn. J. Biol. Chem., 163:773, June, 1946.

RASKA, S. C.: The production of experimental pellagra by adenine. Science, 105:126, January 31, 1947.

## CRUTCH MASTERY

MOST scientific articles describe techniques, principles and practices. Once in a great long while an article appears that yields human understanding. Such is the anonymous article entitled "Crutch Mastery," which appeared in a recent issue of the *American Journal of Surgery*. The author, a physician and victim of infantile paralysis, discusses his fifty years of personal experience with a crutch. It makes good reading, for it is lively, informative, tinged with humor and pathos.

Every physician, every crutch manufacturer or user can profit by reading this article. It is packed with practical suggestions on the use of the crutch, in a variety of environmental situations. The author wades the swiftly flowing waters of a trout stream, alights from moving trains, dons a Beebe diving helmet and negotiates the bottom of a lake, plays golf and tennis, even ascends in a balloon. Whoever he is, the author is a real man.

### SUGGESTED READING

ANONYMOUS: Crutch mastery. Amer. J. Surgery, 73:404, March, 1947.

## TISSUE CULTURE

ALTHOUGH tissue culture work has progressed for many years, seldom has it been applied to clinical investigations. Some authors, however, have suggested its value in the diagnosis of tumors.

Recently, Grace has reviewed the literature of the subject and made some further comments from his own experience. He points out that tumor cells, particularly atypical cells, can be identified more readily by tissue culture methods than by section-

ing. Normal tissue does not proliferate from a single cell, whereas malignant tissue does. Because of this difference in the two types of tissue, an early diagnostic procedure might eventually be developed. Furthermore the degree of malignancy of a tumor cell is proportional to its activity in tissue culture. If the cells are very active, the patient is in danger. The author believes that tissue culture methods should always be used in the diagnosis of Hodgkin's Disease, for with this technique the nodules of this disease can be differentiated from other lymphomas.

SUGGESTED READING

Sano, M. E., and Smith, L.: Tissue culture as a diagnostic aid in the identification of atypical tumors. Arch. Path., 30:504, 1940.

Grand, C. G.: Tissue culture studies of cytoplasmic inclusion bodies in lymph nodes of Hodgkin's Disease. Proc. Soc. Exper. Biol. & Med., 56:229, 1944.

Grace, E. J.: Tissue culture as a clinical aid in the diagnosis of malignant tumors. Amer. J. Surg., 73:326, March, 1947.

## ABORTIFACIENT ACTION OF PENICILLIN

Recent reports have pointed to the possible abortifacient action of penicillin. Four groups of investigators have treated with penicillin a total of 90 pregnant women, most of whom were being treated for syphilis. In this group there were 6 abortions and 13 threatened abortions. Two other groups of investigators administered penicillin to 180 syphilitic pregnant women without a single abortion or threat of abortion. These latter investigators, therefore, do not believe the drug has an abortifacient effect.

In a recent review of the subject, Rainie and Chapin suggest that these discrepant findings may result from impurities in certain commercial penicillin preparation—impurities that have ecbolic properties. When one considers that ergot is a fungus, just as is penicillium, the suggestion does not appear far-fetched.

SUGGESTED READING

Rainie, R. C., and Chapin, M. A.: Abortifacient action of penicillin in pregnancy. J. Maine Med. Assn., 38:23, February, 1947.

## EFFECT OF LEMON JUICE ON TEETH

Some years ago lemon growers and distributors initiated a national advertising campaign designed to promote the sale of lemons. One of their most potent ads proclaimed the virtues of drinking a solution of lemon juice and water, immediately upon arising in the morning. The public did as it was told. Result: Teeth were dissolved by the acid solution.

Stafne and Lovestedt, of the Mayo Clinic, have found that the increased and injudicious use of lemon juice has caused considerable tooth trouble. The teeth become hypersensitive to temperature changes and to hygroscopic substances. Stains and stain lines are absent. Fillings project above the surface of the teeth—the best diagnostic aid. The degree and rapidity of decalcification varied from person to person, depending probably upon differences in amount and buffer capacity of the saliva.

The authors, recognizing the vitamin C content of lemon juice, suggest that if it be used as a therapeutic agent, it should be taken with meals, and not in too great concentration. In other words, lemon juice like all other highly touted panaceas, is easily misused.

SUGGESTED READING

Stafne, E. C., and Lovestedt, S. A.: Dissolution of substance of teeth by lemon juice. Proc. Staff Meet., Mayo Clinic, 22:81, March 5, 1947.

## TOTAL INTRAVENOUS ALIMENTATION

For many years physicians have recognized the desirability of a complete intravenous diet. Only with the development of protein hydrolysates, however, has total intravenous alimentation become possible, and practical. Bigham and his associates point out the many uses of a mixture of protein hydrolysate, glucose, salt, water, and vitamins.

Preoperative and postoperative intravenous feeding has been found of great value in operations for carcinoma of the bowel, in gastric resection, and when intestinal fistulae are present. The gut was found to be small, of good tone, easy to han-

dle and free of contents. Patients were free of postoperative distention and discomfort. In operations for hemorrhoids, where the surgeon desired a temporary cessation of bowel movements, the intravenous method of feeding has kept the patient free of hunger and abdominal distress. Unless there are intestinal lesions of some sort, stools usually cease within two or three days after initiation of intravenous alimentation.

The investigators insist upon total, not partial, intravenous feeding, if the desired result is to be obtained. Further, the treatment must be initiated several days preoperatively, and then used only when indicated. Debilitated surgical patients and those with violent infections are obviously candidates. The treatment is contraindicated in renal insufficiency, hemorrhagic shock, imminent heart failure, and probably severe liver damage.

SUGGESTED READING

Bigham, R. S., et. al.: Total intravenous alimentation, its technics and therapeutic indications. South. Med. J., 40:238, March, 1947.

## CHEMICAL CORPS MEDICAL RESEARCH

Medical progress, made by members of the Armed Forces, is usually under the direction of the Medical Corps. But still another branch of the Army, the Chemical Corps, has also to its credit several significant medical discoveries or developments. Recently, the Chemical Corps has been drafted to take part in the national cancer program. Its job will be the testing of new compounds for the treatment of cancer.

The Chemical Corps already has initiated a most promising line of research. The war gases known as "nitrogen mustards," acquired after the fall of France, have been given intensive study. They are peculiar in that although they are poisonous to nearly all parts of the body, they are particularly destructive to bone marrow and lymph glands. This interesting affinity suggested their use in the treatment of leukemias, Hodgkin's disease, and lymphosarcoma. Initial trials, made by several investigators, indicate that these compounds may be of especial value in the treatment of Hodgkin's disease, relief having been afforded to patients with this disease, who no longer responded to x-ray.

Although only three nitrogen mustards have been investigated as a treatment for cancer, there are over sixty more of these compounds that may yet be tested. It is not unreasonable to expect that these studies will uncover some interesting and useful drugs.

Most physicians are unaware of the fact that the Chemical Warfare Service was largely instrumental in the development of penicillin aerosol therapy of the lungs and bronchi. CWS interest was generated by the necessity of protecting the soldier from smokes and gases, many of which actually are aerosols. In the course of the investigations, attention was given to the feasibility of bringing biologically active materials, chemotherapeutic agents and antibiotics, into the lungs by means of the aerosol technique.

That the Chemical Warfare Service should properly be interested in these possibilities can be readily understood when one considers that during the war bacteriological as well as chemical warfare were subjects of great importance. As a result of studies by members of the Chemical Warfare Service and associated groups, penicillin aerosol therapy was found to be a practical clinical procedure. Penicillin combined with streptomycin or hydrogen peroxide, in aerosol form, has been found of value in the treatment of both tuberculous and non-tuberculous pulmonary suppuration. Further studies in this field will be awaited with great interest.

SUGGESTED READING

Wood, J. R.: Chemical corps joins cancer crusade, Chem. Corps J., 1:30, January, 1947.

Abramson, H. A.: Principles and practice of Aerosol therapy of the lungs and bronchi, Ann. Allergy, 4: 440, November-December, 1946.

R.W.C.

# MEN OF MEDICINE

## *PROBLEM CHILD OF MEDICAL MEN*

STARTING his life as a "dead end kid" in an Irish neighborhood of old Newburgh in suburban Cleveland, Dr. John Augustus Toomey still bears in his personality the marks of early battles. Tall, red faced, with bristly hair, he has always known how to stand on his own two feet and give as well as take it on the chin. If he thinks the scientific theory of a colleague is wrong he can deliver a verbal punch straight from the shoulder. Yet his chief hobby is helping a medical student, an employee, the parent of a patient, or whoever comes along to solve a tough financial or personal problem.

Were it not for his intellectual honesty, mixed with a generous portion of belligerence, Dr. Toomey, at the age of 58, might today be a successful attorney, judge or holder of an important political office. After his graduation from John Carroll University, he studied law at the Cleveland Law School and received his law degree in 1913. He entered as a partner in practice with a young attorney who later became a prominent judge.

But to the astonishment of his friends and colleagues, young Toomey made a sudden switch that sent him upon the high road of success in medical practice, teaching and research.

Upon his graduation from John Carroll, he considered three careers—that of a clergyman, doctor or lawyer. At that time he considered the career of medicine out of the question. It was too expensive. He had worked hard from early boyhood, earning his own way and helping earn the livelihood of his family. So he could easily visualize the struggle he would have to undergo to earn his way through medical school. He says he was not "good enough to be a clergyman." For one thing some of his ordinary vocabulary might not sound so well from a pulpit. So he gravitated into the law, and after a good record at law school, he passed the bar examination.

Self analysis told him that the legal profession seemed best suited to his temperament. It was logical for a young man, who had learned to fight his own battles, to think he could make a living in a profession that demanded such training. He had a ready tongue. The right words flowed out easily. His speech was disarming. So law seemed to be the answer.

But he had hardly put his feet under the desk in his law office, and tacked his shingle on the office door before he became ill at ease. He felt he had made an unwise choice. Law, after all, did not seem to be the right profession.

"Our clients came in for help and advice," he relates. "Most of them were good, honest people who had made mistakes. But they had hardly stepped inside the office door before the lawyers wanted to know how large their bank accounts were or what other assets they had. That was too cold blooded for me. I got out."

He decided to go into medicine. He had worked in Cleveland hospitals to make money to pay his way through college, and the work of the doctors appealed to him. He decided to study for a medical career and enrolled at the School of Medicine at Western Reserve University. Although he worked hard in school, he was not a grind. When

JOHN AUGUSTUS TOOMEY, M. D.

he had to study he did so, and when it came time to relax he knew how to do that.

Before attending Western Reserve, "for practical monetary considerations," he took the job as assistant superintendent of Mount Sinai Hospital in Cleveland—a job that was not much to his liking. He then became steward at the Cleveland City Hospital. He did not last long as a steward, however, because—his colleagues say—he was too honest for the job. But during his stewardship the books at City Hospital ran into the black for the first time in the history of the institution. Neither the Democratic nor Republican city politicians wanted to keep him there because he failed to play the game according to their formula. He was fired from that job.

WHEN HE was graduated from Western Reserve's School of Medicine—at the age of 30—he knew the inner workings of hospitals well. During the first year of interneship at City Hospital, which is affiliated with Western Reserve, he was appointed medical superintendent. The contagious ward was newly created, and it became one of his charges. Treating the children brought there suffering from polio, scarlet fever, smallpox, and a long list of other contagions, he became attracted to the practice of pediatrics, and has pursued that career ever since.

Soft spoken and cheerful, Dr. Toomey has a reassuring manner that inspires confidence in the most irritable child or parent. There is no child so belligerent that he does not succumb to Dr. Toomey's gentle and good humored ways. There is no ruffled, worried or hysterical parent that he is not able to calm by his mild and disarming manner.

Commenting on his way with parents and children he says, "All that I have to do is to use a little horse sense. I try to be truthful and honest. If I find a child will not recover or its disease is fatal, I tell the parents frankly. There is no use beating around the bush about it."

He goes about City Hospital dressed in a long white gown that extends from his chin to the tops of his shoes. His office at the hospital is small with

a tiny cubicle of a waiting room, about large enough for a desk and four or five chairs. There is barely more than enough room in his office for a desk, a few bookcases filled with books, a wash basin and an elevated cot where he examines his patients. The office is comfortably cluttered with papers, books and a few instruments.

His manner, and his methods of handling parents and children have been profitable, not only in terms of friendship and personal satisfaction, but also in terms of money for his extensive researches. Parents have been a good source of funds.

Dr. Toomey is brusk, and his language is pungent, but he has a power and force that make people like him. Those who work for him and with him, in the hospital, and laboratory and at Western Reserve University, where he is professor of clinical pediatrics and contagious diseases, have a strong loyalty to him.

He says his hobbies are "sleeping, reading detective stories and going to Florida once a year." He does take his wife and four children to Florida and reads detective stories. But his hobbies go beyond that. It does not take too long to find out that Dr. Toomey's extra-curricular literary tastes are not confined to detective stories. When necessary he can fling out an apt quotation from Plato, Gracian, Ben Butler, Cardinal Newman, John Stewart Mill, or the Bible. And his colleagues at City Hospital say that his chief hobby is helping other people.

Men and women who have worked for him in the department of contagious diseases at City Hospital, where he is physician in charge, or in his research laboratory, have stayed with him despite many periods of low salary or uncertain pay. They know that if they come to him with a problem, whether it is moral, legal, or a difficult family or financial problem, he will employ his whole weight of intelligence, intuition, experience or judgment to help them solve it.

"We all make mistakes," he says. "But some of us are not slick enough to cover up."

Dr. Toomey may use his legal knowledge in the pursuit of his hobby of helping others, but he has never used it to enhance himself. He has never been a "chronic court testifier," as one colleague expressed it.

SINCE 1923 he has published over two hundred scientific papers on contagious diseases, anti-toxins, vaccines, immunity, serums and related subjects. He has also contributed to several medical texts.

His views on poliomyelitis and the treatment of paralysis, have, for many years, involved him in controversies with other members of the medical profession.

Receiving victims of this disease into City Hospital and watching many of them become helpless cripples, Dr. Toomey, early in his career, looked upon plaster casts for paralysis victims with a great amount of misgiving. Shortly after Dr. Toomey had entered the practice of pediatrics the late Dr. Paul Feiss, who had come to Cleveland's Mount Sinai Hospital from Harvard University, had been treating paralysis victims without the aid of casts.

"We talked and argued," Dr. Toomey relates. "He was argumentative and so was I. I couldn't go along with him fully, but he seemed to know what was fundamentally right. In 1912, while at Harvard, he was the first to impinge the nerves in their shells. When this was done, other nerves would spring forth at the point of impingement. This was the basis for the present operation of neurotripsy.

"As a result of those conversations and arguments, I became interested in the disease. And I have never advised the use of casts." Dr. Toomey's method involves massage and almost immediate treatment of the paralysis at its earliest onset.

Students of Dr. Toomey's at Western Reserve have been amazed at his ability to detect the faintest signs of paralysis.

His ideas were revolutionary and created a great amount of antagonism toward him which has continued until the present time. In spite of the opposition—from men of a much greater amount of experience and standing—young Toomey persisted.

"Soon the public schools began to notice that they did not have so many hopeless cripples," he relates, "and gradually the method infiltrated into the consciousness of physicians."

Perhaps more stormy has been his controversy with other scientific and medical men over the por-

tal of entry of the polio virus into the human system. More than twenty years ago he purported to show that the portal of entry was not the respiratory tract. His ideas were at first rejected flatly. Then medical men began to realize that the solution of the problem of the portal of entry of the polio virus was not so simple as they formerly had thought.

Gradually more medical men have accepted his idea that portal of entry is the gastro-intestinal tract.

"I suppose I have been a problem child among medical men," he says. "I sit back and listen to a lot of bunk and never say much. I try not to interfere, but when I am asked my opinion I give it the best I can."

This is not to say that Dr. Toomey is unreceptive to ideas. Just the opposite. He says he will listen to any idea "no matter how ratty."

"Most advances in medical research come from individuals who have ratty ideas and try them out. If Banting ever had known what was in the literature, he would never have discovered insulin. Authority is the least valuable form of evidence.

"I have had so much experience in trying out ideas that I never consider an idea hopeless even though it is far fetched. I never dismiss an idea just because of some preconceived knowledge I don't believe it to be true. I believe that you should give the fellow who brought out the idea at least the benefit of some thought.

"All sorts of people come into my office, and I listen to them. I never turn them away without hearing their stories. Patients and members of patients' families have supplied me with very good suggestions. I never turn them down.

"I always like to recall that Theobald Smith made his reputation listening to cattlemen in Texas. He turned their homely observations into positive achievements.

"How can I separate the wheat from the chaff? I just use common ordinary horse sense.

"I don't like planned research, and few medical men are able to plan research anyway."

Dr. Toomey has the personality that makes a good medical research man. He combines aggressiveness, stubbornness, bruskness and ruthlessness with natural intelligence. He has the courage to stand up to his adversaries with his beliefs in face of opposition that would make many others cringe and retreat. In his research he has largely worked alone, keeping as his aides loyal, hard-working, and humble men and women who swear by him and his ideas.

His students have been the beneficiaries of his years of accumulation, through reading and practical experience, of a profound philosophy of living and getting along with people. In addressing a recent Western Reserve Medical School graduating class he told the students to "be modest and not loud. Do not harangue the market place and issue a ukase on every trivial thing.

"A prudent silence is always commendable. Speak softly and in good time, and an air of wisdom may be gained. Be not always silent, though if only 'for fear that you might be reputed wise for saying nothing.'

"It is not good taste to talk about yourself. The subject never interests others. Nor should one coyly disparage his own abilities, expecting spoken refutation from the listener. He always secretly agrees with your spoken words.

"Be reserved. Keep something to yourself; don't tell all you know. People will pause longer at your word if they are not quite sure that it is all you have to say. If you've said it all, why should they wait further."

By religion a Roman Catholic, Dr. Toomey believes more in the practical application of religion than in its form, and he admits his church attendence is not too regular. He married Mary Louise Bagot, a Protestant Episcopalian, in 1918 while she was employed as a dietician at the former Thomas Normal Training School. His eldest son, Charles Hugh, is a physician, having graduated from the Western Reserve University Medical School in 1945. One daughter, Frances, was graduated from Vanderbilt University in 1944, and another is attending Flora Stone Mather College at Western Reserve University. John A. Jr., is in preparatory school in Cleveland.

A member of many medical and other scientific societies, Dr. Toomey was recently elected president-elect for 1949 of the American Academy of Pediatrics.

# What Other Editors Think

## Editorial Evaluations of Current Contributions To Medical Progress

### CINEPLASTIC AND KRUKENBERG AMPUTATIONS

THE unused muscle bellies in amputation stumps of arm and forearm have long challenged the ingenuity of surgeons; nor has the design of upper-limb prostheses yet advanced far enough to discourage attempts to utilise the power buried in these stumps. Of the mechanical hands devised and adopted in England and United States, those of Simpson and Hobbs, and the Norden hand which contains a free-wheeling device and may be described as a prosthesis within a prosthesis, all give a grip and a greater range of function than is possible with any single adjustable appliance, but their mechanical function is limited, and they are cosmetically crude.

The cineplastic operation owes its full development to Prof. Ferdinand Sauerbruch, who introduced the use of big, well-buried skin-tubes of local tissue. Since 1918 over 7000 cineplastic amputations have been performed at Sauerbruch's clinic at the Charité Krankenhaus in Berlin, and over 500 in the clinic of Prof. Max Lesche in Munich.

The cineplastic amputation, as done in Berlin, uses a local flap of skin, subcutaneous tissue, and deep fascia about 2 inches square to form the skin tunnel and the secondary defect is covered, not always completely, by a skin-graft. The operation is done under local anæsthesia. Professor Lesche's skin-flap is larger, perhaps 3 inches by 3½ inches; the muscle tunnel is at least 1¼ inches in diameter and lies deep to three-quarters of the diameter of the muscle; the skin and fat tube is rotated through 90° before being passed through the muscle tunnel, so the suture line is proximal and away from the pressure of the peg; and the secondary defect is completely covered by a free graft.

A properly made skin-tube buried in the forearm muscles or in the triceps should give an excursion of 1-2 cm. to a peg about 7 mm. in diameter lying transversely in the tunnel, and should be capable of exerting a power of 15-20 lb.; when buried in the biceps or in the pectoralis major the excursion of the peg should be 5 cm. or more and the power over 40 lb. This power is used to give grip to an artificial hand. Extension of the digits can be provided by a spring device in the prosthesis or by a skin tunnel through the extensor muscles which give voluntary movement—according to the choice of the surgeon.

Cineplastic prostheses are fitted with blocking devices which allow the grip to be maintained without continuous muscular effort. Surgery of this kind requires close cooperation between surgeon and limb-maker. When properly made the cineplastic prosthesis has a fairly wide range of function.

In the Krukenberg forearm amputation, a pincers-like grip is provided by splitting the stump through the interosseous membrane between radius and ulna. At operation, the cleft between radius and ulna is usually deepened to 12 cm., or at least a third of the length of the stump, and is so cut that there is local skin to cover either the ulna or the radius; as a rule, cover for the denuded side is provided by a free graft, but Professor Herlyn at Göttingen uses a belly-arm flap and incorporates an excess of abdominal skin at the depth of the cleft to ensure that there is a fold of flap here, not a suture line. In cutting the cleft, care is taken to preserve the pronator teres, since it is the action of pronation which approximates the two limbs of the pincers. If necessary an ordinary upper-limb prosthesis can be fitted to the stump on occasion. The value of the Krukenberg amputation is limited, but it seems to be worth considering for men who have lost both upper limbs, and particularly for those who are also blind.

—*The Lancet,* Vol. 251, p. 910.

## RENAL PATHOLOGY

For years the kidney has been the subject of considerable study both as regards its anatomical structure, its physiology and the pathological changes incident to it in disease processes.

At a recent meeting of the Physiological Society in England, Trueta, Daniel, Barclay and Franklin made a preliminary report on "Renal Pathology in the Light of Recent Neurovascular Studies." They called attention to the fact that with appropriate nerve stimulation in animals both with the abdomen unopened and in those in which the kidney had been exposed, the renal blood flow may be diverted from its commonly accepted course, and as a result the cortex of the kidney may be partly or wholly deprived of its blood supply.

In their studies they utilized roentgenographic methods and demonstrated these changes in a most striking manner. They found (as a result of the application of a tourniquet for a number of hours to the left hind leg) that the left renal circuit time was shortened by virtually a half, though the caliber of the renal artery was at the same time reduced by a quarter. The only possible explanation of these simultaneous effects was, in their opinion, a vascular short circuiting.

Further proof of this conception of short circuiting of the circulation was shown in laparotomized animals after various types of nerve stimulation. Also, they observed the blue color of the blood in the renal vein changed partially or wholly to red. In some animals the appearance of the red blood was observed to be accompanied by pulsations of arterial type. They also observed that red stream lines appeared in the renal vein after the renal cortex had paled and while it still remained pallid, and that dyes injected into the arterial side of the circulation appeared in the renal vein but did not stain the surface of the kidney, and on section the cortex was seen to be unstained while the medulla, and especially its subcortical part, was deeply colored by the dye.

These observations made on the left kidney were in marked contrast to the right unstimulated kidney in which both cortex and medulla were stained. The former, namely the cortex, was more deeply stained than the medulla. These observations made with the use of dyes were confirmed by roentgenographic methods.

The investigators concluded that as a result of appropriate nerve stimulation the blood supply may be diverted wholly or partly from the cortex and short circuited through medullary (especially subcortical) blood channels. The large potential capacity of these by-passing channels enables them to transmit the whole of the renal blood inflow whenever the supply to the cortex is diverted and the latter thereby rendered ischemic.

Also it seems probable and most likely that nerve stimulation could be produced centrally or peripherally by a variety of noxious agents and that the picture seen in many loosely related syndromes is the result of a defense device by which the cortex of the kidney is excluded from the circulating toxin or other noxious agent, and thus protected.

These observers think that this same protective mechanism may fulfill another role in hemorrhage and shock or conditions with decreased blood volume by preventing the blood from reaching the filter of the kidney, namely the cortex, and thus conserving fluid.

These fundamental experiments may and probably will lead to an elucidation of a host of diseases in which the kidneys play an important part.

*The American Journal of Roentgenology and Radium Therapy, Vol. 57, p. 252.*

## PSYCHONEUROSIS

Psychogenic diseases are in the limelight today. The problems they created in the induction centers and later in the armed forces aroused and demanded justifiable attention. Their importance in civilian life is no less urgent. Although better understood now than in the past, there is yet much to be explained.

The psychiatrists and psychologists, not without exceptions, have stressed the psychologic aspects almost to the exclusion of the physical phase in consideration of etiology whereas other large groups of clinicians have been so fascinated with the findings of purely pathologic lesions as to ignore any other explanations for any bodily complaints. These opinions, are now being challenged

by many internists and other investigators who believe that practically all diseases have really two components, namely, the mental and the physical. They argue that any condition which affects the body will also involve the mind and vice-versa to a certain intent. This concept is considered to be particularly pertinent in the large group usually classified as the psychoneurotic or psychogenic. They contend that only with a proper evaluation of these two factors will a proper understanding of these disorders be made and any rational attempt at treatment be secured.

Recent physiologic studies have helped substantiate these ideas. It is known that conditions such as emotional disturbances affect the autonomic nervous system resulting in visceral changes in the cardiovascular, gastro-intestinal, respiratory or other systems of the body.

Various problems relating to the symptoms have been studied and information from different sources has been made available to show definite physiologic changes. Wolf has demonstrated by actual measurements how anxiety, anger and tension lead to inefficient pulmonary ventilation causing dyspnea. The effect of similar emotional stress and strain on blood pressure or coronary vessels producing heart pain has been substantiated. Anxiety states have been reported by Sargent, to be a factor in the production of actual muscular tension and even fibrillary twitchings in a group of soldiers hospitalized for backache. The sugar tolerance curves have been found to be abnormal more frequently in patients with a diagnosis of psychoneurosis than in controls. The results of other investigations along those lines have appeared recently.

*Archives of Physical Medicine, Vol. 28, p. 237.*

## BACITRACIN

New and effective antibiotics are being discovered from time to time. Some of these antibiotics are very limited in their field of service, others show remarkable effect on many organisms.

One of the latest, apparently very effective of these antibodies was reported on by Johnson, Anker and Meleney in *Science* this fall. This report aroused a great deal of enthusiasm and there are numerous investigators who are anxious to obtain the material to study its effect in various types of infection. Meleney and Johnson have now reported on the first hundred cases of surgical infections treated locally with this particular medicament.

Bacitracin is a filtrate of an aeorbic gram-positive, spore-forming bacillus which has a wide field of antibacterial activity. The preparation has gradually been refined and with this refinement necessarily it has been possible to reduce the size of the dose.

In this present report the drug was used entirely locally, injected directly into furuncles and boils and into deep and superficial abscesses, or applied topically, as in a sty or ulcer of the leg. The cases were not selected and represent the average run of infection which is observed in an ambulatory clinic.

Meleney and his associate found that in 31 cases the results of treatment were excellent, in 57 good, in nine questionable and in only three was there no effect. Bacitracin was found effective in most infections which are resistant to penicillin and in some that did not respond to this particular antibiotic and in only a few instances in which bacitracin failed to bring about a cure did the subsequent response to penicillin become effective.

The medicament is given in two forms; an aqueous solution and the other a water soluble ointment. The aqueous solution was injected directly into the lesion, the ointment was used in such sites where occurred ulcers or directly in the eye in the instance of styes and conjunctivitis.

The authors point out that this new antibiotic which is not locally toxic or irritating and is not inhibited by blood or pus, will be of clinical importance if it can succeed where penicillin or the sulfonamides have failed. Their observations, moreover, point out that this preparation is active against many organisms, coccal in nature, which are resistant to the other two important medicaments.

*New Orleans Medical & Surgical Journal, Vol. 99, p. 523. John H. Musser, M.D., Editor in Chief.*

# Consultation Service

We offer this special consultation information service as a regular monthly feature of *Postgraduate Medicine*. Readers are invited to call on this Service for answers to difficult medical problems from members of our editorial board best qualified to help. Each question will be answered by mail and answers of general interest will be published each month.

## BLOOD PRESSURE VARIATION

*QUESTION: Could you tell me if there is any significance in the fact that a patient has a marked discrepancy in the blood pressure in either arm? She has a BP 136/80 in the left arm and BP of 170/100 in the right arm. Her weight is 212 pounds and she is 46 years of age.*

*M. D.—Minnesota.*

ANSWER: A discrepancy in the blood pressure in the arms may occur with the scalenus anticus syndrome cervical rib aortic aneurism, and occlusion of the brachial axillary or subclavian arteries.

A variation of 10 to 15 mm. in the blood pressure in the arms may occur normally in some individuals as a result of an anatomical difference in the placement of the vessels.

## FALSE SUGAR REACTIONS

*QUESTION: What drugs tend to cause false reactions in testing for sugar? What amount of aspirin will cause such an error?*

*M. D.—North Dakota*

ANSWER: The following drugs have been known to cause in concentrated urine an atypical reduction of some of the copper solutions, chiefly Fehling's Solution: Cincophen, Neo-cincophen, salicylates, amidopyrine; also some of the conjugated glycuronic acids decomposing in the urine after the ingestion of chloral hydrate, camphor, menthol, turpentine or phenol. It might also be stated that excessive amounts of creatinine, uric acid, and chloroform will reduce some of the copper solutions.

However, if one is experienced in doing urines, the reaction will frequently be found to be atypical. It will require at least 30 grains of aspirin to be taken three times a day for this amount to give a reduction of Fehling's Solution, although individuals differ greatly in this respect.

## TRICHOMONA URETHRITIS AND PROSTATITIS

*QUESTION: A white man, age 37, has complained of a urethral discharge of three months' duration. Various smears were apparently negative for gonococci. He has received both sulfonamide and penicillin therapy from other physicians. I do not know in what amount this therapy was given. When the patient was first seen, a few trichomonads were found in his urine specimen and the urethral smear showed mixed gram positive and negative cocci and a few gram negative bacilli. He has improved somewhat on rather large doses of atabrine, given during the past two weeks, and penicillin has cleared his secondary infection. However, he still has a few trichomonads in his prostatic secretion. What is the accepted treatment of trichomonas urethritis and prostatitis?*

*M. D.—Iowa*

ANSWER: Pyridium by mouth has been useful. Massage of prostate gland and instillation of 0.5 per cent to 2 per cent aqueous mercurochrome solution into bladder neck, prostatic urethra and pendulous urethra. The arsphenamines may be given by vein in moderate size doses. Treat wife or sexual partner.

# New Drugs

The information in this department has been supplied to *Postgraduate Medicine* by the manufacturers of the products described.

### QUATRESIN 1:1,000, SOLUTION

PURPOSE: Germicide.

COMPOSITION: Myristyl-gamma-picolinium chloride—0.1 per cent.

DESCRIPTION: A highly potent and non-irritating surgical germicide in aqueous solution. To be used in disinfecting the skin and mucous membranes, irrigation of deep wounds, sinus tracts, compound fractures, or bladder, or urethral irrigations.

ADMINISTRATION: Apply undiluted or diluted up to 1:10.

HOW SUPPLIED AND PRICE: Pint..$0.70; gallon..$4.60.

PRODUCER: The Upjohn Company, Kalamazoo 99, Mich.

### QUATRESIN 1:500, TINCTURE

PURPOSE: Germicide.

COMPOSITION: Myristyl-gamma-picolinium chloride—0.2 per cent.
Acetone—10.0 per cent.
Alcohol—50.0 per cent.

DESCRIPTION: Highly potent surgical germicide in alcohol, acetone, aqueous solution. For use in skin and mucous membrance disinfection and first aid antisepsis.

ADMINISTRATION: Apply undiluted or diluted up to 1:10.

HOW SUPPLIED AND PRICE: Pint..$0.90; gallon..$5.75.

PRODUCER: The Upjohn Company, Kalamazoo 99, Mich.

### "TABLOID" PENICILLIN CALCIUM (BUFFERED) 50,000 UNITS

PURPOSE: In the prevention of secondary infections.

DESCRIPTION: A new oral product, buffered with sodium citrate.

INDICATIONS FOR USE: "Tabloid" Penicillin Calcium is indicated in the prevention of secondary infections such as those following tonsillectomy, tooth extractions and similar conditions. It is used in conjunction with parenteral therapy in gonorrhea, pneumococcic, staphylococcic and streptococcic infections.

HOW SUPPLIED: Sealed in foil strips and supplied in boxes of 20.

PRICE: $7.00, list.

PRODUCER: Burroughs Wellcome & Co., New York, N. Y.

### MEPRANE

PURPOSE: For prompt relief of menopausal symptoms without unpleasant side reactions.

COMPOSITION: Each tablet contains 1 mg. (1/65 grain) 3, 4-bis- (m-methyl-p-propionoxyphenyl) hexane.

DESCRIPTION: A non-steroid compound, strongly estrogenic, and exceptionally well tolerated. Colorless crystals or a white microcrystalline powder. M.P. 113 to 115° C.; odorless; readily soluble in ether, acetone, and ethyl acetate; slightly soluble in alcohol; insoluble in water, dilute acids and dilute alkalies.

INDICATIONS FOR USE: In the clinical manifestations of hypoestrinism as in the treatment of menopausal symptoms. It is indicated for the suppression of lactation.

DOSAGE: Menopause: Initial therapy—1 Meprane tablet t.i.d.; maintenance therapy—1 to 2 tablets daily. For the suppression of lactation: 1 tablet q.i.d. for three days. Dosage in other conditions on request.

CAUTIONS: Those that generally apply to natural and synthetic estrogens.

HOW SUPPLIED: In packages of 30 and 100 individually wrapped tablets. Each tablet contains 1 mg. Meprane.

PRICE: Package of 30s.....$7.80, doz.; $0.65 each
Package of 100s.....19.80, doz.; 1.65 each

PRODUCER: Reed and Carnrick, Jersey City 6, N. J.

### PUROGENATED TOXOIDS

Purogenated Diphtheria Toxoid, Alum Precipitated; Purogenated Tetanus Toxoid, Fluid; Purogenated Tetanus Toxoid, Alum Precipitated; and Purogenated Diphtheria-Tetanus Toxoid, Alum Precipitated.

PURPOSE: Elimination of unpleasant local and constitutional reactions following immunization against diphtheria and tetanus.

COMPOSITION: Proteins, sorted out by fractionating a solution of mixed proteins with wood alcohol at low temperatures.

DESCRIPTION: The new toxoids are 99.7 per cent nitrogen-free, the nonantigenic nitrogen having been reduced to 0.15 per cent approximately. In the forms alum-precipitated, the alum content has been reduced by 75 per cent.

DOSAGE: Dosage required is only one-half the volume usually needed with standard toxoids.

PRODUCER: Lederle Laboratories Division, American Cyanamid Company, Pearl River, N. Y.

# After Hours

## *CLEVELAND'S HOBBYISTS*

Probably the number of physicians whose hobbies have been discovered is no greater in Cleveland, Ohio, than in other large cities. However this month we are directing our attention to some of the Cleveland doctors and their avocations.

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### THE LITERARY GROUP

A man who has always taken keen delight in pleasurable and interesting hobbies is Dr. William T. Corlett, who at age 92, is only in the afternoon of his busy life. Doctor Corlett, long a practitioner of dermatology and syphilology, is now retired. He continues to be active by writing and publishing, at regular intervals, a book of poetry, memoirs or history. It is an inspiration to watch his enthusiasm and accomplishment.

The Cleveland Medical Library has several rooms furnished and endowed by gifts and bequests of members. Among these is the Corlett room endowed by Doctor Corlett, Professor Emeritus of Dermatology, Western Reserve University. The room is set apart for the study of dermatology and is adorned with portraits, busts, prints and photographs of those who contributed to this phase of medicine. The room reflects, to a certain degree, the life work of its donor, containing as it does his library and the furnishings used by him during his long period as a practitioner.

A few years ago Charles C Thomas published Doctor Corlett's "The Medicine-Man of the American Indian and his Cultural Background," a medical picture of most of the aboriginal tribes of the Americas. Doctor Corlett hopes others will study this subject before the old people of the tribes die. Because the offices of priest and physician are combined as one in the medicine-man of the American Indian, the book treats of religion as well as medicine and is almost as much concerned with theology as with pathology.

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### A PSYCHIATRIST'S HOBBIES

The Cleveland Literary group also includes Dr. Louis J. Karnosh, whose book, "A Psychiatrist's Anthology," offers three little poetic gems — "Melancholia," "General Paresis," and "Paranoia." In addition to his literary proclivity, Doctor Karnosh has produced some outstanding wood carvings. One specimen was a nationally advertised radio cabinet. Oil painting and fine printing are his other hobbies.

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### OUTDOOR PURSUITS

During extended visits about southern waters, Dr. R. E. Barney has accumulated a valuable collection of shells. Dr. William H. Weir has had great enjoyment in his garden, being particularly successful with daffodils. "While I can't give much time to the breeding of new varieties," says Doctor Weir, "I am a real daffodil enthusiast and my blooms make a fine showing."

Dr. Norman C. Yarian examines some flasks of orchid seedlings which are being grown upon culture media.

Dr. E. P. McCullagh and Dr. N. C. Yarian have pursued their quests widely, the former for birds' eggs and the latter for orchids. Doctor Yarian has, for the past 18 years, given considerable attention to the study, culture and photographing of orchids, collecting specimens from Central America and Mexico. He writes for various journals on orquidea and is often asked to speak about orchids.